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OUR DWELLINGS
HEALTHY AND UNHEALTHY

BUCKTON.

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OUR DWELLINGS

HEALTHY AND UNHEALTHY

ADDRESSED TO GIRLS ATTENDING THE LEEDS BOARD SCHOOLS

BY

CATHERINE M. BUCKTON

LATE MEMBER OF THE LEEDS SCHOOL BOARD
AUTHOR OF 'HEALTH IN THE HOUSE'
ETC.

WITH NUMEROUS ILLUSTRATIONS

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DEDICATED TO

THE COUNTESS OF AIRLIE

AND

THE HOUSEWIVES OF ENGLAND

CATHERINE M. BUCKTON

27 LADBROKE SQUARE, W.

INTRODUCTION.

THIS little book is only a continuation of my efforts begun immediately on my election to the Leeds School Board in 1873, with a hope that I might eventually induce the Education Department to allow Domestic Economy to be taught to Girls in the lower division of Elementary Schools when they had attained the age of nine, provided it was taught systematically by qualified teachers and intelligent methods based on scientific principles. This instruction is essential for the daughters of working people, and requisite to fit them to enter domestic service—a branch of industry that, I believe, employs the largest number of hands, and one that we know exceeds all others in importance, seeing that the health and comfort of every class depend upon its thorough performance.

The decennial census returns of 1881 tell us that the number of females employed in domestic service in England is no less than 1,250,285, and besides these returns we must not forget to include the 1,200,000 and more wives and mothers who are domestic servants in their own houses.

In order to realise the necessity and justice of my plea, it must be borne in mind that in the case of this large class of the working population the elementary instruction they receive is their only educational training, which may legally end at thirteen, and often ceases, if the Fifth Standard is passed,[1] at eleven from inability to pay the school fees even among respectable artisans where the family is very large, the mother a widow, or in poor homes where there is sickness. It must also be remembered that a girl of nine is often obliged to clean the house, cook, and nurse both mother and baby; and at the age of ten, a girl is frequently sent out into service as a maid of all work, provided she has passed the standard for half-timers, which varies in different districts. As Domestic Economy had not been introduced into the Code in 1873, I had to satisfy my colleagues and myself that subjects classified under this head could be made intelligible, interesting, and of practical value to these young girls.

To accomplish this difficult task, I had first to prepare a systematic course of instruction based on elementary science, and then give the instruction orally to large classes (irrespective of standards), ranging from nine years upwards, out of school hours, illustrated by models and diagrams. Simple experiments enable me to explain the nature of good and bad air, ventilation, and why we have fevers.

To prevent cruel and ignorant treatment of infants and children, to show the necessity for personal cleanliness, and explain how the body can only be well nourished and kept warm by a certain variety of well-cooked food, I had recourse to elementary applied physiology.

My lesson on *clothing*, published in 'Food and Home Cookery' by Messrs. Longman & Co., was illustrated by specimens of the best materials, diagrams, and a specimen outfit for girls, either for home or service. To enable my pupils to realise that every kind of food contains a great many different substances, that these substances are to be found in both animal and vegetable foods, and that the mother's milk is the only food that contains every requisite substance for the complete nourishment of infants, I compiled a small food collection with the component parts of one pound of flour, beef, potatoes, milk, cocoa, tea, and the constituents of an egg.

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[1] The Standard for total exemption in Leeds.

After preparing the information, my own cook gave four demonstration lessons on cookery. The chief object I had in view in preparing these lessons was to show how the flavouring matter is carried away and the nourishing properties of food (which my pupils had previously seen) are injured and wasted by the ignorant English method of cooking in a great hurry by placing saucepans on large fires to *boil away* instead of simmer. After explaining the use of the thermometer, I put one into a kettle of boiling water, and proved that when the contents came up to boiling heat, 212° steam was generated, which escaped out of the kettle, carried off the flavouring matter, and gradually left the kettle empty.

I showed how the most nourishing beef-tea is cooked, so that none of the nourishing properties in the beef can be injured by boiling-heat or be carried away by steam, by cooking the beef-tea in a jar placed in a saucepan of boiling water, where, I told my pupils, it was impossible for the beef-tea to boil. In order to prove this fact, I placed the thermometer in the jar that contained the beef-tea. After explaining the proper heat of an oven for baking, and of fat for frying, by a thermometer,[1] I explained how they might discover the right heat without one, my object throughout being to teach the children how to cook well with a small amount of fuel, by forethought and knowledge. The regular voluntary attendance during all weathers of the children, the intelligent answers to my printed questions (by those who could write), and the testimony of the teachers that the course had increased the intelligence of their pupils and aroused a desire for learning, furnished practical proofs that Domestic Economy could be made intelligible to the large classes for whom I am pleading. Directly provision was made by the Code of 1876 for teaching Domestic Economy, the Board availed themselves of the regulation (Article 19) allowing forty hours for cooking lessons, by appointing a special teacher of cookery. A syllabus of the cooking instruction will be found on page xiii. taken from 'Food and Home Cookery,' the *new* edition of which book contains the cookery scheme adopted by the Leeds School Board.

In about a year after the cookery scheme had been fairly launched, the Board decided to appoint a lady Sanitary teacher to give my course of lessons on the Laws of Health throughout our girls' schools, the apparatus to be carried from school to school by a hand-cart. The syllabus of the instruction taken from 'Health in the House' is given on page xv.

I have troubled my readers with these details in order to show that the methods adopted for teaching Domestic Economy in the Leeds Board Schools are based on the principles afterwards recommended and considered essential by the Royal Commissioners on Technical Education. It will be remembered that this Commission was appointed, in 1881, 'to inquire into the instruction of the industrial classes of certain foreign countries in technical and other subjects for the purpose of comparison with that of the corresponding classes in this country, and into the influence of such instruction on manufacturing and other industries at home and abroad.'

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[1] Negretti & Zambra, Oxford Street, make thermometers for English ovens.

The Royal Commissioners on finding, after a searching inquiry, that theoretical and practical technical instruction given by qualified teachers has exerted a most beneficial effect on the trades and industries of foreign countries, recommend in their second Report, Vol. I., that technical instruction should be given in Elementary Schools adapted to the requirements of this country on the ground (page 117) 'that it is essential that instruction in the rudiments of the sciences bearing on industry should form a part of the curriculum of the Elementary Schools for the great masses of our population, who must necessarily begin and earn their livelihood at an early age.'

'The importance (page 117) of this instruction has so far been acknowledged by the Educational Department, that in all Infant Schools simple lessons on objects and the most commonly recurring phenomena of nature have been made obligatory.

'That this system of instruction, if properly illustrated by the exhibition of the object itself, or of diagrams, or models of the same, or by the simplest kind of experiments, is an excellent foundation for the subsequent teaching of elementary science. When, however, the child enters the Elementary School, the teaching of science practically ceases until it reaches the *upper division*, inasmuch as the arrangement of the class subjects in the lower division is found in practice to exclude science from the division, only two subjects being allowed, of which "*English*" *must be one* and geography may be the other, this latter being generally preferred to the alternative subject of elementary science.'

The following is a copy of the schedule which specifies the instruction classified under the head of 'English,' also the schedule specifying the subjects introduced into the Code in 1876 under the head of Domestic Economy:

CLASS SUBJECT.

English.

To repeat 20 lines of simple verse.	To repeat 40 lines of poetry, and to know their meaning.	To recite with intelligence and expression 60 lines of poetry, and to know their meaning.	To recite 80 lines of poetry, and to explain the words and allusions.
	To point out nouns and verbs.	To point out nouns, verbs, adjectives, adverbs, and personal pronouns, and to form simple sentences containing them.	To parse easy sentences, and to show by examples the use of each of the parts of speech.

To recite 100 lines from some standard poet, and to explain the words and allusions.	To recite 150 lines from Shakespeare or Milton, or some other standard author, and to explain the words and allusions.	To recite 150 lines from Shakespeare or Milton, or some other standard author, and to explain the words and allusions.
To parse and analyse simple sentences, and to know the method of forming English nouns, adjectives, and verbs, from each other.	To parse and analyse a short complex sentence, and to know the meaning and use of Latin prefixes in the formation of English words.	To analyse sentences, and to know prefixes and terminations generally.

SPECIFIC SUBJECT.[1]

12. *Domestic Economy* (*Girls*).

Food: its composition and nutritive value. Clothing and washing.

Food: its functions. The dwelling: warming, cleaning, and ventilation.

Food: its preparation and culinary treatment. Rules for health; the management of a sick room.

(iv.) No scholar may be presented for examination in any specific subject who is not also presented for examination in elementary subjects in Standard V., VI., or VII.

(viii.) No scholars may be presented for examination in specific subjects in any school in which, *at the last preceding inspection*, the percentage of passes in the elementary subjects was less than 70.

It appears to me that the only way of bringing Domestic Economy within reach of every girl attending an Elementary School is to make it a class subject and let it take the place of 'English' in the lower division, for which a grant should only be awarded where the inspector reports that appropriate provision is made for its practical teaching by special and qualified teachers.

For instance, a Sanitary teacher could give a year's systematic technical course of instruction by the method adopted by the Leeds School Board on the following subjects, classified under the head of Domestic Economy: The Laws of Health; the Dwelling, Warming and Ventilation; Food, its composition and nutritive value; Food, its functions, illustrated by models, diagrams, and simple experiments, and by a food collection; a course of Cookery instruction by cookery instructors appointed under the Board. *Cleaning* and *washing* would of course require a separate department similar to those provided by the Manchester and Sheffield School Boards for teaching manual work to Boys. The Royal Commissioners, after visiting these departments, make the following statement in their Report, page 523:

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[1] The three stages of such of these subjects as admit of it may be taken in any order.

'That after having had the opportunity of further considering the value of *manual work as a part* of primary instruction, and after having seen such work introduced into Elementary Schools of various grades in other countries besides France, are able to express a stronger opinion in its favour than at the time of their *first Report*. They do this with greater confidence because, in consequence partly of the suggestion contained in that Report, the experiment of introducing manual work into primary schools has been successfully effected by at least two School Boards in this country, viz. Manchester and Sheffield.'

The manual instruction for Girls would, I hope, include sweeping, scrubbing, dusting, bedmaking, washing and ironing, cleaning of utensils, furniture, windows, kitchen flues, boilers, cisterns, and every sanitary apparatus to be found in a cottage dwelling.

The plant for fitting up a department for teaching domestic work might, if judiciously selected, be purchased at a very small cost, and prove very helpful by showing how much can be made of a small space by ingenuity and order. This manual instruction need only occupy half the day. The course might last for six months, or more if possible. It will be seen by a study of the Code Regulations for teaching Domestic onomy that this subject is entirely out of the reach he girls for whom it is most needed.

hen again, Domestic Economy as now taught is a waste of public money and useless because, as I understand, every subject except cookery is taught simply by means of rules and information culled from textbooks in the Training Colleges and Elementary Schools throughout the kingdom.

I need not tell anyone that Domestic Economy so taught is worse than useless, because it imposes an impossible task. Judging from my knowledge of the elementary question and practical experience of the necessities of the working classes, I feel that no real or lasting success can attend any legislative measures for improving the dwellings of the poor, or for the erection of healthy houses for all classes, until the laws of health and the other branches of domestic economy are thoroughly taught in our Elementary Schools and made an essential part of primary instruction.

COOKERY SCHEME.

Syllabus of the Instruction taken from the new edition of 'Food and Home Cookery.'

Period occupied by each Lesson		
1 week	I.	*Demonstration.*—Use of damper, clean oven flues, lay a fire, &c.
2 weeks	II.	*Practice.*—Each girl to lay a fire in fire-basket, clean wooden, china, and glass utensils.
2 „	III.	*Practice.*—Clean iron, brass, and metal utensils.
1 week	IV.	*Demonstration.*—Bread making, show how to weigh by spoons, jugs, &c., without scales, &c.
2 weeks		*Practice.*—Each girl to measure out her own ingredients and make a bread cake.
1 week	V.	*Demonstration.*—Make a tea-cake, rock buns, &c.
2 weeks		*Practice.*—Each girl to measure out her own ingredients, and make a tea-cake.

Period occupied by each Lesson		
1 week	VI.	*Demonstration.*—Right heat for cooking, boil and poach an egg, make egg sandwiches, grill a chop, &c.
2 weeks		*Practice.*—Each girl to boil or poach an egg, make a sandwich, help to grill a chop.
1 week	VII.	*Demonstration.*—Roast beef, Yorkshire pudding, cook a cabbage, &c.
2 weeks		*Practice.*—Prepare jointly a Yorkshire pudding, practise beating an egg, clean a cabbage.
1 week	VIII.	*Demonstration.*—Make a suet dumpling, clean and cook a fish, &c.
2 weeks		*Practice.*—Each girl to make a suet dumpling, &c.
1 week	IX.	*Demonstration.*—Make a jam turnover, clarify dripping, &c.
2 weeks		*Practice.*—Each girl to measure her ingredients, and make a jam turnover.
1 week	X.	*Demonstration.*—Make Cornish pasties and rice mould, &c.
2 weeks		*Practice.*—Each girl to make a Cornish pasty.
1 week	XI.	*Demonstration.*—Fry fish and bread, make a baked rice pudding, &c
2 weeks		*Practice.*—Each girl to fry a piece of bread and make a small rice pudding.
1 week	XII.	*Demonstration.*—Invalid cooking; beef-tea, gruel, &c.
2 weeks		*Practice.*—Each girl to prepare one ounce of beef for beef-tea, and make half a pint of gruel.
1 week	XIII.	*Demonstration.*—Boiled custard, mould of rice, cup of cocoa, &c.
2 weeks		*Practice.*—Each girl to make a cup of custard, cup of cocoa, slice of dry toast.
1 week	XIV.	*Demonstration.*—Vegetable soup, roly-poly, &c.
2 weeks		*Practice.*—All assist in making vegetable soup, each girl to make a roly-poly.
2 weeks	XV.	*Practice.*—Each girl to make a cup of porridge, cup of arrowroot, &c.
Total 40		Information about the best kind of pans is given in pages 2, 3, and 89, not in Lesson XV.

NOTE.—Every cookery centre, of which there are twenty, is provided with a Food Collection. According to the Scheme a classroom will eventually be fitted up as a cookery centre in every girls' school.

Each girl during the above course makes the following eighteen dishes *entirely herself*: A bread-cake or small cottage loaf, tea-cake, jam turnover, a Cornish pasty, a small baked rice pudding, half a pint of milk gruel, a cup of boiled custard, baked roly-poly, dry toast, cup of arrowroot, cup of cocoa, cup of porridge, cup mould of rice, boil an egg, make an egg sandwich, beef-tea, grill a chop, fry a piece of bread or fish. The following dishes are prepared jointly: Vegetable soup, Yorkshire pudding, suet dumpling with currants, roast beef, roast pork, potatoes, greens.

SANITARY SCHEME.

Syllabus of the Instruction taken from 'Health tin he House.'

PAGE	
1	Nature of good air ; the skin ; necessity for cleanliness ; how to prevent dying of thirst at sea.
8	Nature of bad air; ventilation; why we have fevers; how to prevent the spread of infection.
17	Why dumb animals have fevers; cruel treatment of infants caused by ignorance.
24	Information on the structure of the human frame to prevent ignorant practices.
36	Why children have bent legs and weak frames ; the circulation.
43	Explain how the body is nourished by the circulation of the blood; and how to prevent a person from bleeding to death.
49	Why people faint; how heat is formed in the body; use of thermometer; proper heat of a hot bath.
55	Why infants and children ought to be well clothed; croup; how to restore a fainting or drowning person.
63	General treatment of animals, especially horses; show model of horse's hoof.
76	How we digest our food the teeth.
81	Digestion.

PAGE	
87	Foods that make fat and cause the heat which is in our bodies; why infants cannot digest solid food.
93	Foods that make flesh, muscle, and nerves.
98	The harm spirits do to our organs; water the most important of all foods.
104	Why the mother's milk is the only food that contains every requisite for the complete nourishment of infants; why people have scurvy.
154	Why it is very dangerous to frighten children and give them quack medicines; the organ of hearing.
	The Lesson on Clothing is taken from 'Food and Home Cookery,' page 88. Outfit for girls on page 11.

N.B.—The admission of Boys in the Upper Standard has been allowed in mixed schools. The scholars in forty-four schools are under instruction, as classes from nine other schools attend some of the thirty-five centres. The classes range from fourteen to eighty children. Greatest number present in one month, March 1882, was 3,146.

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OUR DWELLINGS.

CHAPTER I.

DESCRIPTION OF THE MODEL OF A HEALTHY WORKING MAN'S DWELLING.

IT gives me great pleasure to feel that there may be some old friends amongst my audience to-night, who attended the course of lectures I gave about four years ago on the 'Laws of Health.' Ever since those pleasant meetings my spare time has been devoted to preparing information about the 'Dwelling,' with the hope that it might be the means of enabling women to reduce the terrible amount of preventable diseases and suffering caused by unhealthy homes, and the ignorance that everywhere exists as to how to take care of them, and keep them healthy.

In order to render this information useful and interesting, I have had two models constructed, one representing a healthy working man's cottage, and the other an unhealthy dwelling, in which will be found nearly every sanitary defect a cottage home in Leeds could possess. Before you can understand the nature of these defects, and realise the danger of living in an unhealthy, badly built house, you must first learn the principles on which a house should be built to be healthy, and then examine my model of a healthy dwelling now standing before you, in which these principles have been carried out.

I must tell you that this model is not an *exact* copy

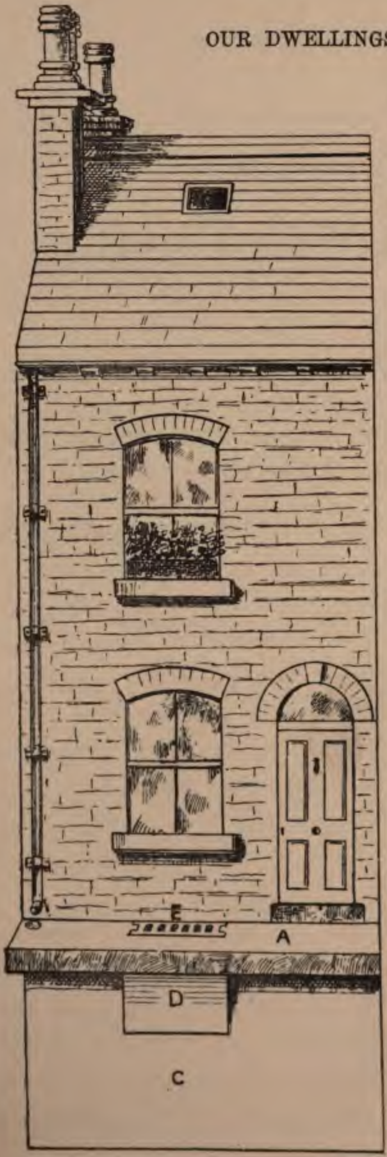

Fig. 1.—Front view of the model of a healthy cottage dwelling, decorated with two of the window boxes that gained prizes at the Leeds School Board Flower Show.

A, footpath; E, grating over space D, that admits light and air into the cellar window; C, cellar wall.

of any house I have seen, but is planned so as to have the comforts and conveniences I think every cottage home should possess, and built on the same principles upon which every house must be constructed to be healthy, whether it be a palace for a prince, or a cottage for the poorest labourer. According to these principles, the soil on which a house stands must be wholesome, the foundations firm and dry, the building materials good. It must have thorough ventilation, sunlight in every living-room during some part of the day, a plentiful and constant supply of pure water, and a system of drainage for removing all solid refuse and dirty water *instantly* out of the house. No bad air from a drain or cesspool, containing this refuse or dirty water, must be able to find its way back into the house, or into the water used in it for drinking purposes, for directly drain air enters a house, those who live in it may at any time suffer from the complaints written on that sheet, the names of which I will read aloud: diphtheria, cholera, diarrhœa, typhoid fever, scarlet fever, typhus fever, sore throat (called a drain throat), erysipelas, whitlow, boils, bronchitis, sickness, headache, faintness, weak nerves, and a certain kind of fever that poor mothers catch after their babies are born, when they are recovering and weak.

The model-maker who constructed my models was a Leeds man who had a practical knowledge of a builder's trade, and thoroughly understood certain important laws which every Leeds man and woman ought to know about, called the 'Leeds Building Bye-laws,' a copy of which may be bought for 2*s*. These laws have been framed by a body of gentlemen (called the Corporation, elected by the votes of every man and woman, rich and poor, who has lived in a house in the borough for a year), whose duty it is to manage all matters relating to health and other important affairs of the town. These bye-laws enable the Corporation to compel builders, landlords, and speculators to construct healthy houses, and punish them in case they disobey their laws.

You will hardly believe the wicked, cruel things that are done by unscrupulous builders and speculators, who make their money by erecting cheap unhealthy houses, built of unwholesome material, but which look so smart that ignorant people are tempted to buy or rent them. For instance, instead of using good lime and clean sand, necessary to make good mortar, concrete, and plaster, they use sea-sand, which contains salt, and grind up road scrapings, ashpit refuse, and old lime full of animal matter previously used in tan-pits with which to make their mortar and plaster. Concrete made of this filthy rubbish never grows hard, and therefore cannot prevent damp from passing through it, and the mortar neither sets nor binds the bricks together. The walls that are plastered with this rubbish never dry thoroughly, and in time the greasy matter it contains strikes through the whitewash. To make matters worse, these walls, before they are papered, are washed over with unwholesome size, made from impure glue, and then covered over with a bad wall-paper that has also been made of unwholesome materials, dirty pieces of paper and rags gathered from middens, &c. Unhealthy walls such as these, Mr. Teale[1] tells us, are no doubt the cause of illnesses from which people suffer who inhabit newly finished houses. Directly a nail is driven into a wall where sham mortar and plaster have been used, half the wall very often comes down. These 'jerry builders,' as they are commonly termed (jerry is a slang term for sham), also buy second-hand drain pipes called seconds, which leak, for about half price, instead of using good glazed stoneware pipes, or iron ones that can be bought covered with a substance that prevents them from rusting.

I am thankful to say that magistrates not only have the power to fine or imprison builders and speculators found using sham mortar or any building materials that are not good, but can also compel them to pull down houses that are badly built.

In proof of this statement I will read a newspaper report of a case which appeared in the 'Leeds Mercury' of August 25, 1883.

> JERRY BUILDINGS.—T. B., a builder, was charged at the Highgate Police-court a few days since for erecting some houses with mortar which was chiefly made with garden-mould. At the first hearing of the summons an adjournment was granted, to allow the defendant to amend the bad

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[1] *Dangers to Health*, by T. Pridgin Teale, M.A.

work ; but, instead of doing so, he had completed the houses and gone into liquidation. The district surveyor said that the houses were so badly built that they ought to be pulled down. Mr. Bodkin, the sitting magistrate, fined the defendant 2*l.* for each house, and 10*s.* a day since June 23rd, when the notice was served, making the aggregate penalties nearly 100*l.*, and advised that a summons should be taken out against the defendant to compel him to pull the houses down. If penalties such as these were often inflicted, this style of building would soon cease ; but, although the bye-laws of the Metropolitan Board of Works are very stringent as to the composition of mortar, which should be made only of washed sand and lime, yet proceedings are rarely taken against builders in the metropolis. There is one advantage to the public as regards penalties ordered at police-courts—viz., that in the event of their not being paid, or there not being sufficient goods on a distress being levied, the defendant will be sent to prison for a lengthened period, if the case be followed up. It is to be hoped that, although the defendant's affairs are in liquidation, he will not be allowed to get off without making payment of the penalties, or going to prison.—*British Medical Journal.*

You will also be pleased to hear that the Leeds building bye-laws require that all building materials shall be good, and another bye-law says that the soil on which a house is to be erected must be wholesome and free from any refuse or offensive matter. Seeing that the health of a house greatly depends upon the kind of soil it rests on, everybody ought to understand something about the nature of the soil beneath our feet. The soils considered the best to build on are those that consist of either pure sand or gravel, because they contain and *retain* most heat, and also allow water to pass through them so easily that they drain themselves, and are therefore dry and warm. A soil through which water cannot pass, such as stiff clay, requires to have drains cut through it in order to carry off the water and render it healthy and fit to build on. Besides pure sand and gravel, the following soils are considered healthy: granite, rock, sandstone, and *stiff well-drained* clay. A marshy sandy soil in which plants grow or a damp *soft* clay are considered the most unhealthy of all *natural* soils.

I am sorry to tell you that many thousands of houses in all parts of Great Britain stand on poisonous soils made, not by nature, but by unscrupulous men. For instance, they will sometimes dig out the pure gravel or sand upon which the house ought to have stood to sell it, and then fill up the space with filthy rubbish, or they will sometimes build houses on a place where rubbish and night soil have been thrown for several years, and then cover it over with earth to make it look like good soil. People whose houses stand on a poisonous soil will breathe poisonous air, because there is a great deal of air in the soil beneath our feet called *ground air* which is always in motion and ready to rush up into a warm house (especially at night when windows and doors are shut) through the foundation, and also through the cellar *walls*, for air can pass through bricks and stones. This fact is proved by the following experiment. Gas (which is a kind of air) is sent through either a brick or a stone, and when it comes out on the opposite side, if a light is held to it, the gas instantly bursts into a flame.

The only way to construct a safe and healthy foundation for a house is to cover every bit of the soil under it and line the trenches dug out for the foundation walls to rest on with from four to six inches of good concrete, cement, or some substance that will keep out ground air, damp, and especially *rats*. Rats can fill the most healthy house with drain air by making an underground roadway through the soil from the drain, cesspool, or filth, out of which they have come.

I learnt this fact during a short residence in a house near Leeds (built before the bye-laws were made), which we had taken because we thought it would be very healthy as there were no drain pipes under it, and no water-closets or drain pipes within its walls. However, a bad smell was perceived when a fire was lighted in the drawing-room, and a builder was sent for to discover the cause. After taking up some boards he dropped down into what is called a 'dummy cellar,' a dark place without windows or ventilation, in which the soil or earth at the bottom was left with no concrete or covering to keep out the damp. By the aid of a light a dead rat was found, but we felt sure the horrid, damp, close smell that filled the room directly the boards were taken up could not be caused altogether by the dead rat, as it had not begun to decompose. In the course of a week or two it proved that this cellar and the one under the dining-room were both full of rats, which must have come out of the street drain by means of an underground road they had made for themselves through the garden, either by the side of the rainfall pipe that discharged its contents into the street drain, or by the side of our neighbour's drain. When we found that the walls of the house rested on the damp soil without any concrete under them, we no longer felt surprised that the wall paper was quite wet in some places, because we knew that bricks and stone will suck up and hold a great deal of water, especially soft stone and bad bricks.

A common brick, Mr. E. Turner says in his valuable book, 'Hints to Householders,' will absorb and contain within itself a clear pint of water, a cubic foot of granite half a pint. In an ordinary eleven-roomed house it is calculated there are about 150,000 bricks; if every one of these bricks were saturated (that is, were quite full of water) such a house would hold 17,000 gallons of water!

I fear there are not many cottage houses or even mansions that have the soil they stand on covered with concrete or any substance to keep out ground air and damp. A *damp* soil causes rheumatism, colds, neuralgia, consumption, and a *moist* soil may give fevers, cholera, and dysentery. Living rooms ought to be well raised above the ground by cellars built on dry foundations, and the bedrooms should always be as high up as possible, because complaints are more frequently taken during sleep than at any other time, no doubt owing to the fact that during the day fresh air, exercise, and the perspiration it causes, help to carry off any poison that may have entered the blood. A maid servant of ours lived in a large country house before she came to us, where the servants' bedrooms were all underground. She was soon seized, for the first time in her life, with inflammation of the lungs, and obliged to return home, where she was laid up for fourteen months, and she still suffers from a delicate chest. A fellow servant had also to leave about the same time afflicted with pleurisy, and has never recovered her voice.

A healthy, comfortable bedroom, fitted up with every necessary arrangement for personal cleanliness, appears to my mind more essential for servants than for any other member of a household, because loss of health and strength deprives them of the only means of gaining their daily bread and providing for old age. A bedroom below the level of the ground, however well built and drained the house may be, is only a cellar dwelling, and cellar dwellings are forbidden by the building bye-laws of London and other towns as being unsuitable for human habitation.

CHAPTER II.

PLAN OF A HEALTHY DWELLING.

Before ordering my model of a healthy dwelling, I furnished the model-maker with the plan on which I wished it to be constructed, and a list of the requisites for health and comfort it must contain, so that he might be able to calculate whether a landlord or builder in Leeds could let such a house as I wanted at the rent I wished (5*s*. 6*d*. a week), and still make a profit of 5 per cent.

This, he informed me, was quite possible, provided it was one of a row. A single house would naturally cost more. The land required for each house would be about eighty square yards at say 5*s*. a yard (a very common price for land in Leeds), which would leave about 180*l*. for the building alone.

According to the plan I had drawn, the house was to have a backyard and two underground cellars, because I knew that cellars, when well built and airy, make a house drier, more healthy, and furnish excellent places for keeping food, coals, and wood. Over the cellars, on what is called the ground floor, there was to be one large comfortable living-room, and at the back of it a small room, called a scullery, where the washing and dirty work could be done.[1] This room was to have a bath and a boiler (called in Yorkshire a set pot), but no fireplace, because I have so often seen a whole family crowding into a small back room during the week, and the large comfortable room left for Sundays or when visitors came. In the first storey (over the living room and scullery) there were to be two bedrooms, each provided with a fireplace and also a cupboard. The attic, or second storey, was fitted up with a fireplace so as to serve as a third bedroom.

I desired that my house should be the first in the row, and stand in a well-paved street running north and south, open at both ends to secure a thorough current of air. The width of the street was to be sufficient in proportion to the height of the houses on both sides of it, to allow direct sunlight to enter every *living* room during some part of the day, sunlight being considered as necessary for health as fresh air. My house was also to be on the east side of the street and so have a south-east aspect (aspect means the outlook from the front of the house), because I knew that with this aspect the sun would shine on the front of the house from early morning to about eleven, and on the back from about one until the evening. I was anxious that the back should be the most sunny side, as the back yard, though small, is where the clothes would be dried, and might serve as a playground for the little ones; the scullery too, from having no fireplace, would be the better, I thought, for all the sunshine it could get.

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[1] Dimensions of rooms on page 13, fig. 2.

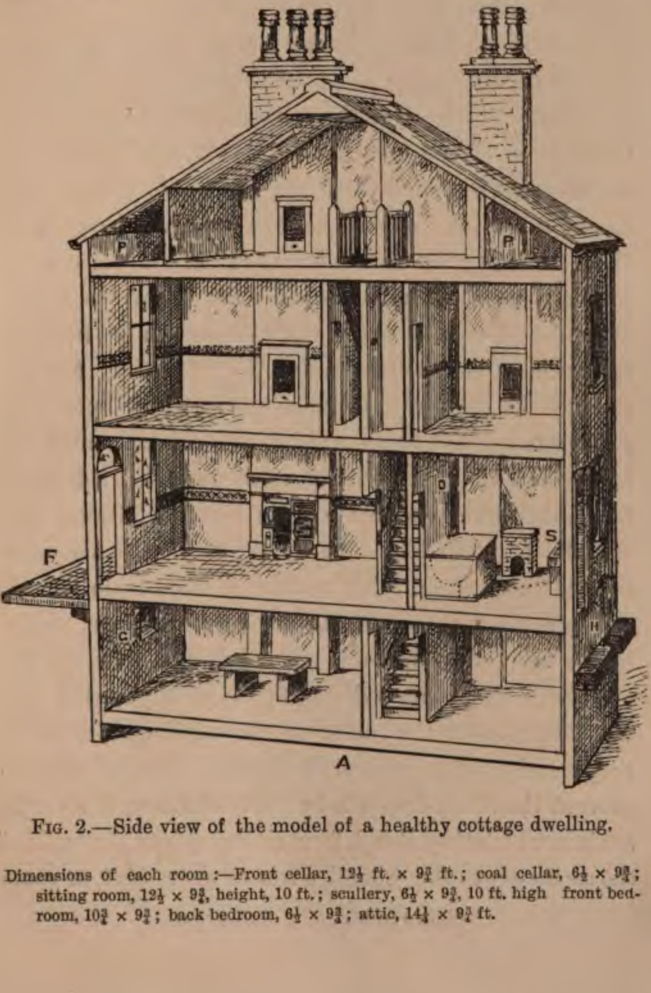

FIG. 2.—Side view of the model of a healthy cottage dwelling.

Dimensions of each room:—Front cellar, 12½ ft. × 9¾ ft.; coal cellar, 6½ × 9¾; sitting room, 12½ × 9¾, height, 10 ft.; scullery, 6½ × 9¾, 10 ft. high front bedroom, 10¾ × 9¾; back bedroom, 6½ × 9¾; attic, 14¼ × 9¾ ft.

It is now time you should examine the model itself. By removing this side wall and all the doors you will be able to see the interior of every room and look under the cellar floor, fig. 2, p. 13.

I must ask you to picture the soil under the house to be a pure gravel covered entirely with good concrete four inches thick; and the same concrete is also put at the bottom of the trenches under the bricks that form the foundations called 'footings,' see fig. 6, p. 32.[1] The building bye-laws require that the walls which rest upon these footings shall be two bricks thick, and the footings under them one-third wider, in order to furnish a good support. You must notice that a space A is left between the foundations and the cellar floor for air. Air will prevent the wooden joists that support the floor from getting damp and being subject to a disease called *dry rot*, caused by a tiny living creature called a fungus, which eats away the inside of the wood and leaves only a shell that crumbles into dust. Dry rot is also considered unhealthy. To secure a circulation of air through the space under the floor gratings are placed in the walls opposite each other. If you look on the outside of the cellar walls, C, fig. 1, p. 2, you will find they are painted the colour of the earth against which they stand, so as to show their depth. Now, in order to prevent the damp drawn in by the bricks from this earth, against which they stand, from rising up into the walls of the rooms above the ground, a row of slates (felt, or some

[1] Shown in Fig. 6 by dotted lines.

substance which will keep down the damp) is placed on the top of the walls directly they have risen above the level of the ground shown by this dark line, which is carried round the walls of the backyard, see fig. 6, p. 32.

This row of slates, *b*, is called the 'damp proof course.' Whenever you see damp walls in rooms above ground and the wall-papers peeling off, you may be sure that the damp proof course has been forgotten. Houses that have an area at the back and front, standing in a row, do not require the damp proof course.

We will now enter the basement, see fig. 2, p. 13, and first examine the small coal cellar at the back of the house on our right. The light and fresh air in this cellar comes through the slide in the wall, H, down which the coal is thrown from the backyard, and when the window, G, in the front cellar is open, a current of air will pass through the whole of the basement. At the back of the cellar stairs there is a space which serves as a chip place, fig. 6, p. 32. The front cellar, into which I have now brought you, makes an excellent larder (that means a place for keeping food), owing to its being dry, well ventilated, cool in summer, and safe from drain air, because no drains run under the house and no rats can enter it, owing to the foundation being covered with concrete.

The fixtures provided for holding food are also good and ample, namely, the stone table you see in the centre of the room, these shelves by the wall, and hooks fastened to the ceiling for hanging bacon or meat. A fixture means any article of furniture that has been *fixed* into the walls of the house by either the landlord or tenant. A tenant ought, therefore, to contrive not to allow any furniture to be so fixed; merely have it so placed against the wall so that it can be removed when he leaves the house.

The white lime-wash which covers the walls not only makes the cellar look clean and light, but has a very purifying effect, because lime contains that wonderful gas called oxygen, about which you heard so much during my lectures on the 'Laws of Health,' that destroys all germs of disease. This gas also purifies the air we breathe, the water we drink, helps to create all the heat on this earth, and changes the nature of whatever it touches. The glass bottle I hold in my hand is filled with oxygen gas. If there is time at the end of my lecture I will put this piece of charcoal with a tiny spark of heat at the end, into the gas, when you will see the tiny spark changed into a bright flame. When the flame dies out you will find the bottle filled with quite a different kind of gas, called carbonic acid gas, that puts out light and heat.

While I am speaking about suitable plans for keeping food, I must tell you that a cupboard fixed into the wall through which a current of air cannot pass to ventilate it, is a very bad place for keeping fresh food, such as meat, butter, milk, &c. When I found that our only larder in London consisted of a wall cupboard fixed in the area close to the dust-place, I bought two wooden safes (cupboards with wire sides to admit a through current of air), and put them on stands in the little garden at the back of the house, and covered the tops with a piece of tarpauling to keep out the rain; one holds the meat and the other butter, milk, sweets, &c. I am glad to say experience has proved these safes to be excellent keeping places. Cupboards fixed in walls that are the least damp often become infested with red ants, because these terrible insects are brought to life by warmth and damp. A short time since a wall in our kitchen was made damp by our neighbour's boiler, and the dresser that stood close to the wall became covered with red ants. I had the dresser immediately removed about two inches for air to circulate at the back and dry the wall, when the ants at once disappeared.

I will now conduct you up the cellar stairs, to the ground floor, and at the top of the stairs we shall find a door, O (Fig. 2, p. 13), that opens into the scullery, in which room there are several fixtures. The first we come to you see is a boiler on our left (or set-pot, as it is called in Yorkshire). This oblong box, standing on the right against the inner wall, is a cast iron bath, with a wooden lid, made full size so that every member of the family can use it.

The lid when down serves as a small table. I will just raise it for you to look inside; the shape being oval with a rounded bottom takes as little water to fill it as possible. The sink, S, is placed where every sink should stand, by an outer wall and by a window, where there is plenty of light and air. The sink stone is of glazed earthenware, because stone allows the greasy water to sink into it, which causes an unpleasant smell in the scullery. The ceiling space in this room between the door and the boiler might be utilised by a wooden rack for either drying or airing clothes, such as you see in this picture, taken from a sketch that I made of a rack on which some clothes were hanging to air. The rack was suspended to the ceiling by a strong loop of cord tied at each of the corners, fastened on to the four hooks in the ceiling. The owner of the rack assured me she possessed no article of furniture she valued more : indeed, she said she did not know what she should do without it, especially on a washing day.

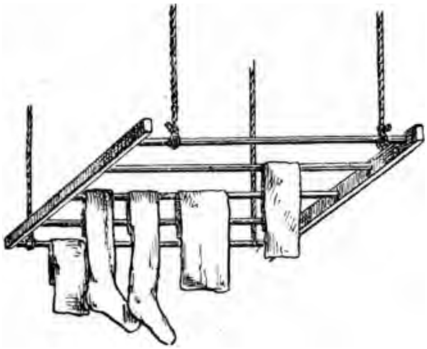

FIG. 3.—Wooden rack for scullery ceiling for drying and airing clothes.

I was surprised that the clothes were not in the way, as the room was only 8 ft. 7 in. high. This room is 10 ft. I find that the price of a rack made of birch 5 ft. by 5 ft. if it had to be bought would be about 7*s.* 6*d.*: that is allowing five shillings for labour and two for wood, so that, if made by a member of the family, the cost would only be about 2*s.* 6*d.* Deal would cost less, but if the deal were not thoroughly dry the rack would be spoilt by the shrinking and warping of the wood.

This room is whitewashed, and the walls of every other room in the house are coloured, not papered.

CHAPTER III.

WALL-DECORATIONS AND COLOURING.

We will now go through the scullery door into the sitting-room. I think you will agree with me that this room has a pretty, cheerful effect, though it contains no furniture to set it off. This pleasant effect is owing to the colouring and wall decorations, and to the room being well proportioned. (Dimensions under Fig. 2, page 13.) The walls are coloured with distemper, which is said to be 'better than all the papers in the world.' Distemper consists of a wash made of whitening and colouring matter, with size or glue to make the wash stick to the wall. Walls that are distempered can also be ornamented with graceful patterns and borders by a process called stencilling. A sheet of paper, varying from 11 to 22 inches long, on which the pattern is drawn and then cut out, is held to the wall and then brushed over with distemper, thus leaving an impression of the pattern on the wall; the sheet is then removed to another place, and so on until the decoration is completed. I have brought some stencilled sheets for you to look at.

A new method of distempering ceilings and walls, called 'Duresco,' has lately been invented, which allows the walls and ceiling to be washed with cold water, and is said to answer perfectly. The distemper colours used in this process are warranted free from any poisonous matter, and are sold, I am told, ready for use with full directions.

I decided that the walls of this, the living-room, should be a pretty shade of yellow ochre, because yellow is a colour that reflects light at night and makes a room look bright and sunny by day. Dark colours, and others that suck in the light instead of throwing it off, such as blue and green, require a much greater amount of gas or candle to make them light up. You see that the lower part of the room (which soon gets dirty) is a much darker shade, verging on brown, than the upper part, for the height of three feet. I hope you admire the stencilled border that runs above the darker part. Though patterns for stencilling can be bought, now that drawing is taught in all our Board schools, we may hope that in time the walls of cottage homes, mantel-pieces, &c., will sometimes be decorated with patterns designed by clever members of the family. One of the prettiest mantel-pieces I have seen was a wooden one in a working man's cottage that had been painted, and the pattern designed, by a member of the family.

Directions[1] shall be given you at the end of the lecture for distempering and limewashing, which will show you how much easier and cleaner it is to colour a room than to paper it. The colouring process only requires brushes, and buckets to hold the wash, and water to wash off the old colouring matter; on the other hand, to paper a room you must first take off the old paper, wash the walls, and then brush them over with size; there must also be a long table on which to cut and paste the paper. After all this trouble the paper and pattern on it may not be hung straight, and worse than all, the paper may be coloured with poisonous paints or made of unwholesome materials such as I mentioned, pieces of dirty old rags, and paper picked off middens or stripped off walls where perhaps sickness and fever have been. People who know anything about paper-making can tell by looking at a paper on the wrong side whether it is made of refuse such as I have described, because in that case it will be brown not white, and also rough, owing to the bits of impurities that were in the materials used to make the pulp. A paper made of clean white rags, &c., will be white and smooth on the wrong side.

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[1] See Directions, p. 144.

I will now show you some specimens of good as well as bad papers. Arsenic and poisonous colours of every shade are, alas! to be found alike in the cheapest and most costly papers. Mr. Pridgin Teale tells us in his book on 'Dangers to Health' how his children were made ill by sleeping in a room with a wall-paper that contained arsenic; directly it was taken off the walls the children recovered. A friend of mine, the wife of a working man, told me her son took small-pox by stripping a paper off a wall where a person had suffered from this terrible complaint. Many people have the dirty habit of leaving the old paper on the wall, and covering it over with a new one. Mr. Teale also tells us that as many as five dirty papers have been found on the wall of a living-room. To prove how ignorant even educated people are on this subject, a house-decorator told me he once received a severe scolding from a rich gentleman whose house he was painting and papering, for having taken off an old paper. The gentleman said it was both foolish and a waste of time to have done so. Another great advantage of colouring walls instead of papering them, is, that in case of an infectious complaint attacking any member of a family, a room with coloured walls can easily be purified by being recoloured.

I must not forget to tell you that there are many conscientious paper manufacturers who make all their papers, from the cheapest to the dearest, of wholesome materials in every shade of colour. Messrs. Woollams of London is a well-known firm. The safest plan is to buy wall-paper, colouring matter, and glue or size, from respectable tradesmen who get their goods from the best makers. As my model is made of wood, the walls could not be coloured with a wash, but are painted to represent distemper. The doors and window frames and mantel-piece are painted a dark shade of yellow ochre almost brown, to harmonise with the lower part of the walls.

CHAPTER IV.

VENTILATION.

NONE of the windows in the *model* will open, but in the real house they are all to be made to open, both top and bottom, and have a simple arrangement by which an opening is left between the two centre rails, to admit a constant supply of fresh air, either by day or night without rain. By looking at the drawing of a window, p. 109, you will see at once that this middle opening is contrived by simply making the piece of wood belonging to the bottom of the lower sash, called the bead, so deep that it will allow the window to be thrown up two or three inches without leaving any opening at the bottom. This arrangement, of course, prevents the window being fastened in the usual way, but a screw like this put in on each side will fasten the sashes together very securely. In our house, which has been built many years, we have only a piece of wood that fits below the lower sash and can be removed when desired. I do not think it would be necessary to fasten any window looking into a street, except those on the ground floor. In case a bed had to stand near a window the blind should be pulled down over the opening, because the blind would serve as a screen or wall, and conduct the air to the top, where it would escape into the room through the space that always ought to be left between the roller blind and the window frame.

We will now take leave of the ground floor, and visit the two bedrooms above that occupy the first storey. As we go up the stairs, you must notice that there is a low rail (Fig. 2, p. 13), up the side of the wall which the little ones can reach, a necessary provision in all stairs that have no banisters. If we turn to the left we shall find ourselves in the bedroom that looks to the front, F; the walls of this room and the one at the back are both distempered a light shade of pink with a dado of Venetian red. Every colour used in the house is warranted to be free from arsenic or any poisonous matter. I have provided a cupboard for each room on this storey; if you could look inside them you would see that they are both ventilated by a grating fixed in the wall that separates them. When the windows and cupboard doors in both rooms are thrown open, a good current of air will pass through them. All cupboards for hanging clothes require to be well-ventilated, especially if the clothes have been used by those who work hard.

After you have looked into the back room, which is just like the front one, only a little smaller, we will go up into the attic, where we shall find a good-sized room, $14\frac{1}{4} \times 9\frac{3}{4}$, which is the third bedroom. The top of the attic stairs you see is guarded by a railing, without which an attic is a dangerous room at night. The walls are coloured in distemper with one shade only, and without any stencilling decorations, and look to my taste very pretty; I selected a light salmon tint, because I thought this colour would give a warm and cheerful look to the room.

Seeing that I promised that no space should be wasted in my healthy house, I expect you will wonder why the space, P (Fig. 2, p. 13), behind the walls at each end of the attic, is not made into cupboards, by putting a door in each wall; I will, therefore, explain that, owing to the slanting roof, these spaces are very low, dark, and unventilated, and the Leeds Corporation have therefore wisely made a bye-law to compel builders to close up these spaces lest they should be used. About fifteen years ago, before the Leeds bye-laws were in force, and when, I regret to say, I knew very little about house sanitation, we lived in a new well-built house in Leeds in which two large attics were provided for servants' bedrooms. Our cook, after sleeping in one of them for a fortnight, became so ill with sore throat, that I was obliged to send her home for a time to be nursed and to recover her strength. After this attack of sickness I removed the servants to a large room on the floor below, which had an open grate and windows that opened both top and bottom. My reasons for taking this step were that I did not think these attics could be healthy, as neither of them had an open fire-place, and because the skylight could never be left open except by day in warm, still weather. Directly rain or snow came, or when the wind was high, these windows had to be closed to keep out the rain, or to prevent the wind from either blowing the skylight away, or making such a noise that no one could sleep. Each attic had a space similar to this you see in my model. In one, two cisterns were kept that supplied the bath-room with hot and cold water, and the other served as a box-room. There was a door to each of these closets, but they were so dark that the cisterns and contents could only be seen by the aid of a lighted candle. I did not learn until after we had left the house two or three years, that in the cold water cistern there was an overflow pipe that went down straight into a drain. This pipe, of course, made a way for drain air to enter the attic, and also to enter and poison the water in the cistern which supplied the bath.

This history will, I think, prove the necessity for closing all dark and ill-ventilated places, and show how dangerous it is to place any sanitary apparatus, especially water cisterns, out of sight. Cisterns ought also to be placed far away from any bad air, such as would come from ventilating drain or soil pipes or dust heaps, and where there is good ventilation and light, so that they can easily be examined and cleaned.

I must now call your attention to the window that lights the attic, because it is constructed to admit fresh air in stormy or rainy weather, when it is necessary that the skylight should be closed. Instead of only one pane of glass, two pieces of glass (marked C in the section) are made to lap over each other, and there is a wooden rail, H, at the bottom of the inner one, which is perforated with holes to admit air. When the weather is fine the window can be left wide open by

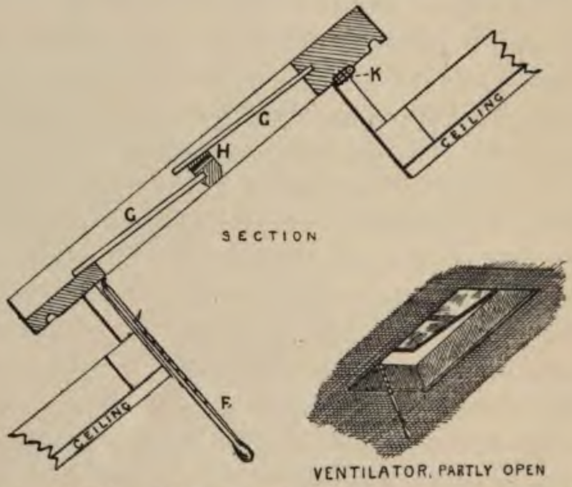

FIG. 4.—Skylight window that admits fresh air through centre rail when window is closed. Section of window, from which a joiner could make the same.

means of this long iron handle, S, that has holes to fix it on to the hook on the lower part of the window-frame. The second drawing shows a section of the window, from which a joiner would understand how to make a similar one.

A well-ventilated, cheerful attic in a healthy house, free from drain air, with coloured walls and an open fire-place, would make an excellent bedroom or sickroom, where a patient might be nursed without danger of infection being spread, provided these directions, drawn up for me by Mr. Wheelhouse, F.R.C.S., the eminent Leeds medical man, were carefully followed (*see* p. 151). As it is almost impossible to commit them all to memory, a printed copy should be kept in every house ready for an emergency. An attic has the advantage of being high up where the air is the freshest, and it is also the quietest part of the house.

It now only remains for us to examine the chimney flues, which I can let you see by turning the opposite side of the model towards you, from which the side walls have been removed (Fig. 5, p. 30). You must know that every fire ought to have a *separate* flue or chimney to carry off its smoke; the inside of the chimney must be quite smooth; if the bricks or stones of which it is built are left standing out like steps, the soot will rest on them and take fire, should a spark alight on this ledge or step. Now we must find out whether my chimneys are all that they should be; we will first examine the one belonging to the fire-place in the living-room; it has, you see, a flue to itself which is quite smooth, F. Though the scullery has no fire-place it has a boiler, and the fire under the boiler must have a flue to carry away the smoke; here is the little flue, B, entering this larger flue, F, that carries the smoke up into the chimney stack. The front and back bedroom flues, F F, are also properly constructed. The attic flue can only partly be shown by the photograph, but we may feel sure that it, like the rest, is perfectly smooth and separate.

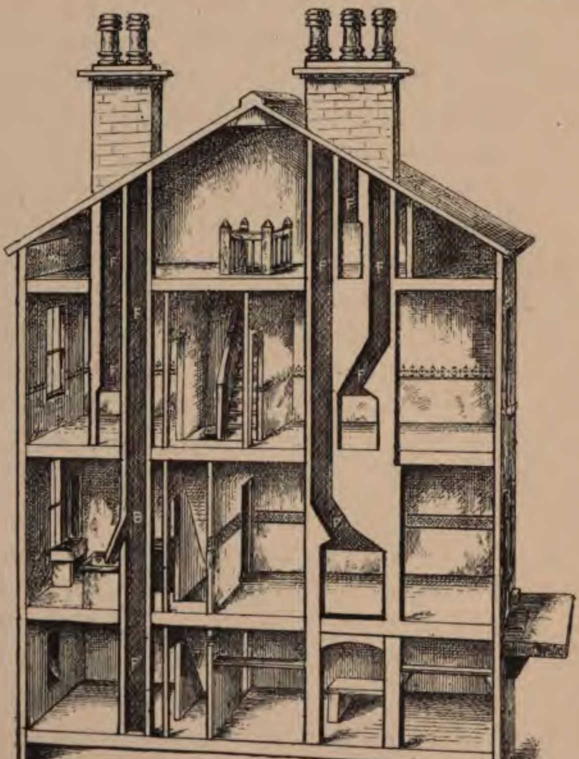

FIG. 5.—Side of model removed to show the chimney flues belonging to each fireplace.

F, flues; B, boiler-flue.

In houses badly built one flue will open into the other, and the bricks of the walls, as I told you, project like steps, and form ledges on which the soot lodges. As the model now stands, we are also able to see the shelves for food in the front cellar, the place for firewood under the cellar stairs, and the opening, like a window, in the back cellar through which the coals are thrown.

The model, you must remember, represents one house of a row. I will now turn it round so that you may look at the front (Fig. 1, p. 2), and be able to peep under the causeway, because it is under the causeway I am sorry to say that builders often put the dustbin, a most dangerous place for keeping any kind of refuse. The projection, D, which looks like a box, forms an open space in front of the cellar window to admit light and air. Every window, both back and front, has a good broad window-sill, which will shoot off the rain on to the footway, instead of allowing it to trickle down the walls and make the walls damp; these broad sills will hold window-boxes or flower pots.

You must now examine the roof of the house, which is covered with Welsh blue slates that are considered the best kind, because they are cheap, light, and strong: poor slates are always out of order, being too weak even to bear the weight of the workman sent to repair them. Unless a roof is well constructed and watertight, it becomes a constant cause of damp and expense. The roof of a house may also prove a great source of danger to health in many ways. For instance, unscrupulous builders sometimes carry the rain-gutter quite through the roof, and connect it with a rain-pipe that goes straight

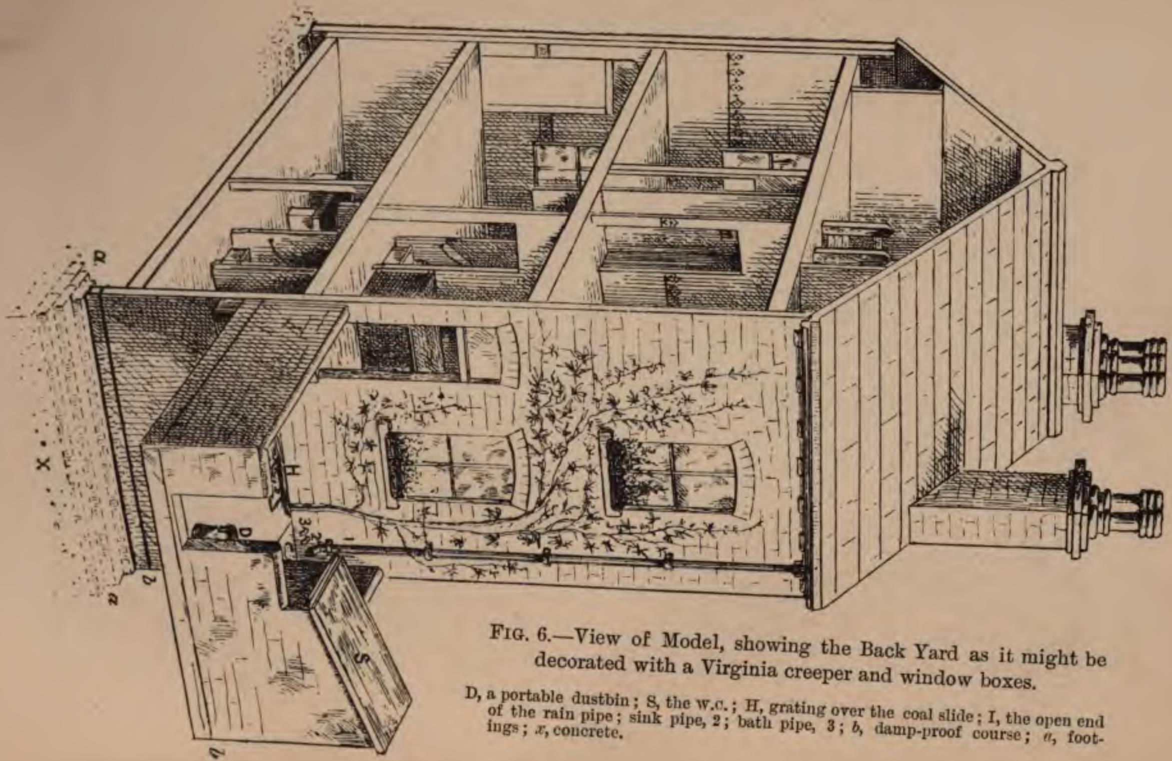

Fig. 6.—View of Model, showing the Back Yard as it might be decorated with a Virginia creeper and window boxes.

D, a portable dustbin; S, the w.c.; H, grating over the coal slide; I, the open end of the rain pipe; sink pipe, 2; bath pipe, 3; *b*, damp-proof course; *a*, footings; *x*, concrete.

down into a drain, thus making a road for drain air to fly up into the roof; they also have a most dangerous practice of carrying a ventilating pipe up from a drain into a chimney. If there is no fire in the room to cause a draught up the chimney, or when there is a down-draught, the drain air will be brought into the room by this ventilating pipe.

Near Leeds there is a country place celebrated for its lovely mountain scenery, fine air, and pure water, where delicate children and invalids are sent from all parts of the country. Not long ago a girls' school was visited from time to time by scarlet-fever, and at last one of the pupils died of it. When this sad event occurred, the sanitary authorities were compelled to examine the house; after a long search it was found that a ventilating pipe from the drain had been placed by the architect in the chimney of the room where the poor girl had died!

You must now observe that the rain-pipe (Fig. 1, p. 2), which passes down the front of the house, is not connected or joined to a drain, because the end is left open, so that the rain water must run out into the open air before it enters the grate below that leads into the drain. A pipe like this, which is not connected or joined to another pipe, but is left open at the bottom, is said to be 'disconnected.' I must ask you to remember this long word, because it is the right word to use in speaking of a pipe when it discharges its contents into the open air.

We must now turn the model and examine the back yard (Fig. 6, p. 32). Though it is but small, a space of even this size is most valuable, indeed in many cases the daily bread of a family depends on having some out-house or yard where a barrow or truck can be kept; with cleanliness and a taste for plants, this little open space might be made very pretty. As the model now stands I think you will be able to see every part of the yard; here under the scullery window is the coal-hole, H, covered by the grating that I told you admitted a constant supply of fresh air into the cellars. The water-closet, S, which stands at the end of the yard, has an opening over the door and a window at the side for ventilation. Close by the yard gate is a portable iron dustbin,[1] with a lid to keep out the rain, and two handles to enable the dustman to carry it out and empty the contents into his cart, without making a litter in the yard. Dustbins,

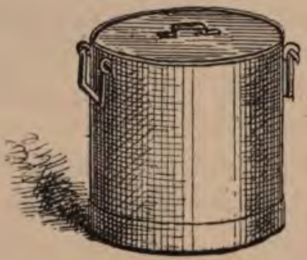

FIG. 7.—A portable galvanised dustbin, suitable for the back yard of a cottage.

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[1] Maker, C. Turner, 25 Silver Street, Kensington, London.

especially in cottage houses, ought to be emptied at least once a week. In Paris the ashes and refuse are removed in portable bins from every house daily. Ashbins and dustholes, I am sorry to say, are often most dirty and dangerous places. The worst kind are those sunk below the level of the ground, often placed under a footway or in a back yard. Directly the rain mixes with the animal and vegetable refuse thrown in by careless, thriftless housekeepers, poisonous gases arise that may cause sickness and fevers.

CHAPTER V.

DRAIN-PIPES AND TRAPS.

WE will now enter the scullery, as I wish to give you some little information about the bath. It is made of cast iron enamelled inside, has circular ends, and is rounded at the bottom to take as little water as possible. The form is shown in dotted lines (Fig. 2, p. 13). The pipe—also shown by dotted lines (Fig. 2, p. 13)—that carries away the dirty water has a trap, passes under the floor, and discharges its contents into the open air. Traps are things about which I shall soon have a good deal to tell you. This pipe at the bottom of the bath, to carry away the dirty water, can be plugged up by a piece of lead that is fastened to the bath by a chain. When a cold bath is wanted, the water will have to be carried by some utensil from the tap over the sink; in case a hot bath is required, the water must be heated either over the kitchen fire or in the boiler, which is close to the bath, and can be easily supplied, as the boiler has a tap. A bath in a large house would have two taps just above it, one for hot and the other for cold water; and also two pipes, one at the bottom to carry away the dirty water, and the other at the top to carry off the water in case the bath became too full and overflowed; this latter pipe is called an overflow pipe. I am sorry to say that in many large mansions these two pipes go down straight into a drain, and so make two entrances for drain air to fly up, generally into a bedroom; for in many of these houses every large bedroom is provided with a bathroom that leads out of it.

A friend of mine who had a London house where all the large bedrooms had a bathroom, told me that at one time she constantly suffered from a sore throat. When one of her daughters was seized with a terrible attack of fever, she sent for a sanitary engineer to see if the drains were all right. He soon discovered that the pipe to carry off the dirty water and the overflow pipe in the bath in her daughter's dressing-room, and the pipes in every bath in the house, went down straight into the drain. After this announcement the daughter was removed from the house and the drainage set right.

Though my bath does not possess every convenience, it is so simply constructed that it will not easily get out of order, and I am thankful to think that it can never injure those who use it.

Now we must examine the sink-stone (*see* Fig. 9, p. 46), and find the mouth of the pipe that carries away the dirty water; here it is, covered with a grating which is fastened down to prevent any bits of solid matter from getting into the pipe to stop it up. These bits of grease, &c. should be put into a jar kept by the sink to receive them, and then be burnt as soon as possible.[1] The sink-pipe, like the bath-pipe (No. 2), passes through the outer wall, and if you look outside you will see that the end is left open, so that the water, when it runs out, falls into the open air and then into the same grating that receives the rain and bath-water I must ask you to look under the sink, and observe how the sink-pipe is bent like the letter S. Notice that the bottom of the bent part, which forms a little basin, is full of water. This little basin of water is called a water-trap, because water is said to prevent drain air from escaping through it, just as a mouse-trap prevents a mouse from passing out. But you must know that a water-trap is not nearly so strong a trap as a mouse-trap, because a mouse is never able to force its way out, but drain air has often been known not only to force its way out of a water-trap, but to have eaten holes in the walls of the trap in order to make its escape. Here is an old trap made of lead in which you can see the holes that have been eaten through it by drain air. After hearing that a water trap is a very weak trap, you will wonder why I have fixed one under the sink, especially as you see that the sink-pipe does not go down into a drain. My reason for doing so is because I know that clean water can keep out a certain quantity of drain air or foul air, such as would arise from the sink-trap or from the pipe in case it were dirty inside.

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[1] *See* Rules, p. 140.

I am sorry to say that a great many of the traps that are placed inside and outside of thousands and thousands of houses are very dangerous to health, because they not only allow drain air to pass through them and enter the house through the sink, bath, lavatory, and water-closets, but give out a constant supply of foul air themselves, owing to their filthy condition and the sewage that collects at the bottom of them.

It would be useless as well as impossible for me now to give you the names of all the bad traps that are still in use. As a rule their names give some little idea of their form, as you will find on examining these drawings of four well-known traps that are considered to be the most dangerous. No. 1, p. 40, is called a D trap and, as you see, resembles the letter D turned upside down. The entrance hole to receive the refuse and water is here at the top, A, and the pipe, B, that carries the refuse out of the trap down into the drain, is on the left. This pipe, B, that goes into the drain is better shown in this drawing (Fig. 21, p. 69). In well-constructed traps the water that is sent into them drives the refuse out of the traps, washes every part, and leaves a sufficient quantity of clean water at the bottom to cover the entrance into the pipe, which leads into the drain. But the water in entering a D trap never reaches any part but the bottom, because the water passes down the pipe, C, you see inside the trap marked by dotted lines. The upper sides of the trap and the bottom part of the pipe, C, soon become covered with filth or sewage. This filth creates foul gases that fill the trap, eat away the bottom part of pipe C, and make their escape either through the opening, A, at the top, or by eating their way through the walls of the trap. The pipe, C, has been found to be so much eaten away

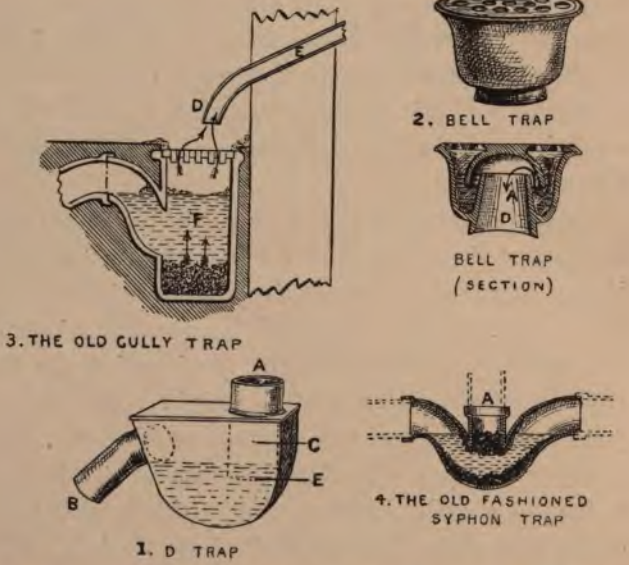

FIG. 8.—Drawings of four of the most dangerous traps, namely:—No. 1, D trap, No. 2, bell trap, No. 3, the old gully trap, No. 4, the old-fashioned syphon trap, which is still much used to separate the house drain from the street sewer.

as to have become too short for the end, E, to dip into the water at the bottom of the trap. Then, as you will see by looking at Fig. 21, p. 69, the air from the drain will be able to fly up into the trap and escape into the house.

D traps are still, alas! much used, not only under a w.-c., but under a lavatory in a bedroom or dressing-room. A lavatory is quite as dangerous as either a w.-c. or a bath, because, besides the D trap, it may have an overflow pipe and a waste-pipe going into a drain. I know of two cases of typhoid fever that were caused by a lavatory in a bedroom.

Trap No. 2 is called a bell trap, and the form, as you see, resembles a handbell with the cup part standing up. This trap, though much smaller than the D trap, is equally dangerous, because it is often placed under a sink in the scullery, where a cook or scullery maid spends a great part of her time. The centre of the bell, shown in the section, is, you see, nearly filled up by the pipe, D, that carries the sink water away into the drain. The top of this pipe is covered by a cup-shaped lid, the sides of which dip into the water that surrounds the pipe and forms the trap. As the trap only holds about a teacupful of water you may be sure that drain air will find no difficulty in forcing its way through it.

Water takes so long a time to run out through the narrow passage marked by an arrow into pipe D, that a servant when she is in a hurry naturally lifts up the grating to which the cup-shaped lid, A, is attached to let the water run away, when the drain air will of course fly out of the open pipe into the scullery.

Then, again, the trap soon becomes filled with solid bits, and the only way of cleansing it is by removing the lid. A large-sized bell trap is sometimes placed under a dish-stone either inside or outside a house.

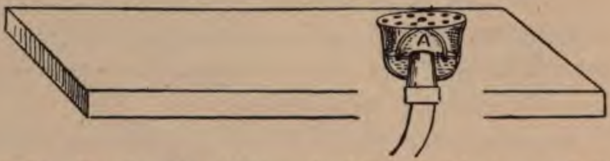

FIG. 8A.—Drawing of a Bell-trap fixed into a sink-stone, and the sink pipe going into the drain.

A, cup-shaped lid fastened to grating.

I must now mention the fact that in all traps that are flat at the bottom a dirty sediment collects which the water, in passing through, cannot remove; these traps are therefore considered to be dangerous. If you look at the drawing of trap No. 3, known by the name of the old gully trap, you will see that it is flat at the bottom. The arrows point the way in which the bad air from the dirty sediment is passing out and up the sink pipe D, because this pipe is placed exactly over the trap. Gully means a passage leading into a trap or any receptacle.

No. 4 trap is called the old-fashioned syphon trap. A syphon is a bent pipe or tube.

If you look at this drawing you will see that this old-fashioned syphon trap consists of a syphon that has a wide bend with a raised place, A, in the centre of it like the neck of a bottle. The water in passing through the syphon trap rushes up this raised place in its centre in order to find its level, and carries with it paper and all kinds of filth, which in time completely fill up the neck. Then, again, owing to the great width of the bend, refuse also collects at the bottom of the trap, as you can see in the picture; thus this trap becomes gradually choked up. An old-fashioned syphon trap was placed at the bottom of the man-hole in our area to separate the house drains from the sewer in the street. We accidentally discovered this fact from a man sent down to examine the drain, who begged we would come and see the terrible state the trap was in. The trap was so filled with filth that in a week or two nothing could have passed through it; the result would have been that the foul water and sewage would all have remained under our house. I am told that these traps are still constantly placed under the man-hole of very large houses. You will find that every trap in my healthy dwelling is made on the same principle as the one under the sink, which, you remember, consists of a syphon or round pipe turned up at the bottom and at the top in the shape of the letter S, for which reason it is called the S syphon trap.

These traps are recommended by the first sanitary engineers and plumbers of the day, for the following reasons: (1st) because the water sent down carries all the sewage and foul water clean out of them, owing to the shape of the bend, which is narrow; (2nd) because the trap is left full of water, which rises high enough to thoroughly cover the entrance into the drain pipe. In some traps a rush of water will force all the water out of them.

CHAPTER VI.

CONSTRUCTION AND TESTING OF HOUSE-DRAINS.

YOU must know that sanitary engineers not only require that all pipes that carry foul water from a sink, or waste water from a bath, lavatory, &c., should have good traps and be disconnected, but they say that every trap, drain, and soil pipe should be ventilated; that is, have a current of fresh air passing constantly through them. They also say that the soil pipe to a w.-c. must have a ventilating pipe the same diameter as the soil pipe, which must be carried up into the fresh air away from any opening in the roof, such as a chimney or window, through which the drain air might enter the house.

I must tell you that the owner of a house is compelled by law to construct and pay for every drain his house requires. He is also bound to unite his house drain to the main sewer in the street, provided he lives in a town, or to a cesspool if he lives in the country. I have carried my house drain through the back yard and joined it to the sewer which runs down the back street. You shall now see a second model of the back yard, which will enable me to show you the house drain passing under it and united to the sewer. I was obliged to have the pipes, traps, and w.-c. made of glass instead of stoneware in order that you might understand their construction, and be able to watch

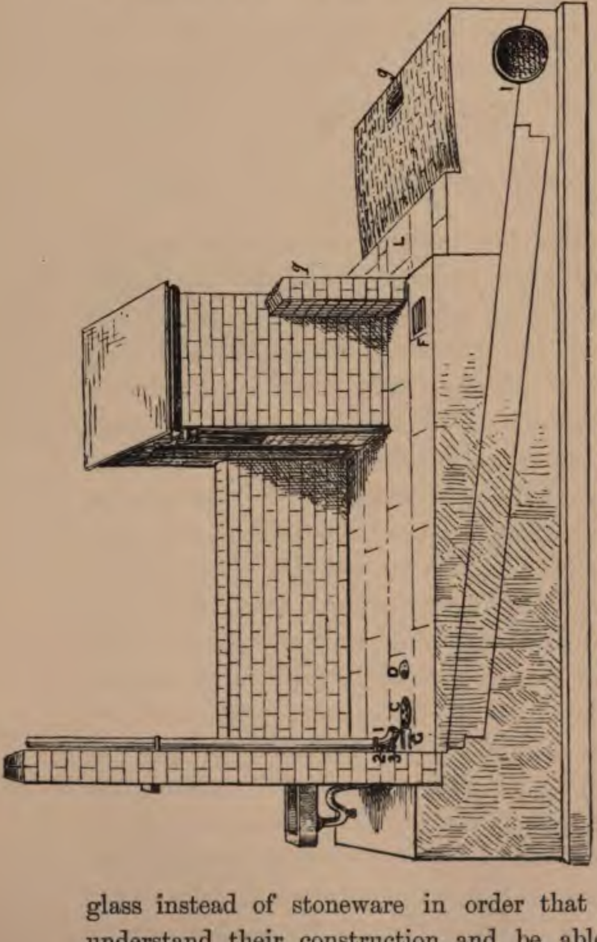

FIG. 9.—Model of back yard under which the house drain passes.

The scullery wall on the left with the sink stone and trap and the open ends of the sink pipe, 2, and the bath pipe, 3, coming through the wall to discharge their contents over groove G, before entering the grating C, which covers the trapped gully at the top of the drain. Grating D covers the gully to admit air and the brush to cleanse the drain. Grating F at the end of the yard covers the trap that separates the house drain from the sewer and also an opening on the left of the trap that admits air to ventilate the house drain. *q* is the wall at the bottom of the yard; L, the footpath in back street; *g*, a grating to ventilate the street sewer; I, an opening into the sewer.

how the pipes carry away the dirty water out of the house, and the sewage from the w.-c. in the yard, into the sewer in the back street.

My drains can all be examined without any trouble, because the pavement in the back yard and over the back street can be removed in a minute.

Before I take up the pavement I had better give you a short explanation of the model, Fig. 9. To begin, the wall to the left is a portion of the scullery wall, showing the sink-stone, sink-pipe, with a trap and a screw under it to let out dirty water, and leave an opening to insert brush for cleaning the trap and pipe.

I have now removed the pavement over the yard drain and back street (Fig. 10, p. 48), and wish you to observe that the drain pipes go down the yard and into the street sewer in a slanting position, to enable the contents to run away instantly and to fall into the sewer.

Pipes so placed in a slanting position are said to have a good fall (one foot in thirty feet). As all the traps are filled with coloured water (red) you can see at a glance that the form of these is such as I described—a pipe curved like the letter S. I will now pour some clean water that is not coloured down the scullery sink and drain, to prove how instantaneously the contents are removed out of the yard into the sewer. Now watch how it runs through the sink pipe out into the open air, down the first trap, then through the second trap, and now it has entered the sewer in the back street, and is rushing down it as it would do in the real sewer.

As the water that stood in the traps was red, we shall be able to see whether the traps have done their work well, that is, have removed all the coloured water, and left a sufficient quantity of clean water to fill the traps and cover the opening in the pipe out of which drain air might escape. Yes! the trap under the sink

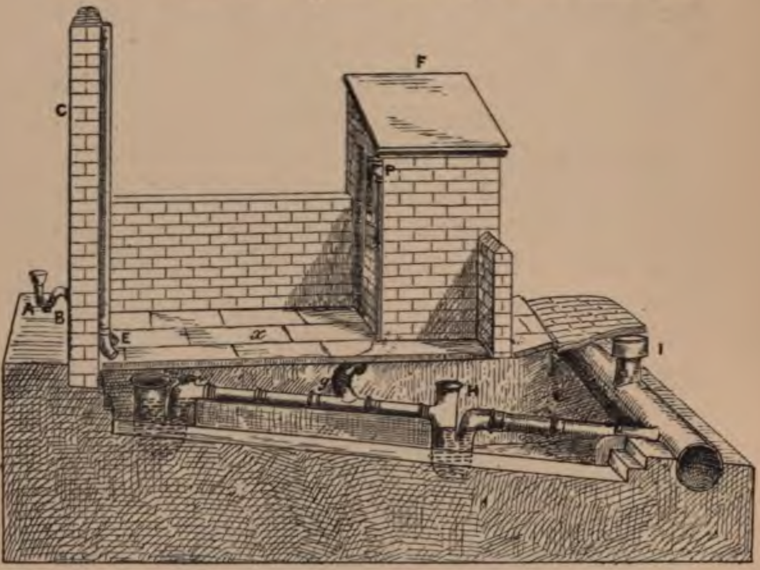

FIG. 10.—View of back yard with the pavement removed to show the two trapped gullies and the house drain passing down the yard and entering the sewer in back street.

g, soil pipe to w.-c., entering the house drain with a curve; P, ventilating pipe to soil pipe; H, the trapped gully at the end of yard, with an opening on the left to admit air to ventilate the house drain; 1, open gully that ventilates the sewer in back street.

is full of clean water, the two traps in the yard are filled, and the openings that lead into the drain are covered with water.

You must look at the soil pipe from the w.-c., and observe how it is carried into the yard drain with a bend, not straight; that is, at right angles, because in that case some of the contents might then pass up as well as down the yard drain.

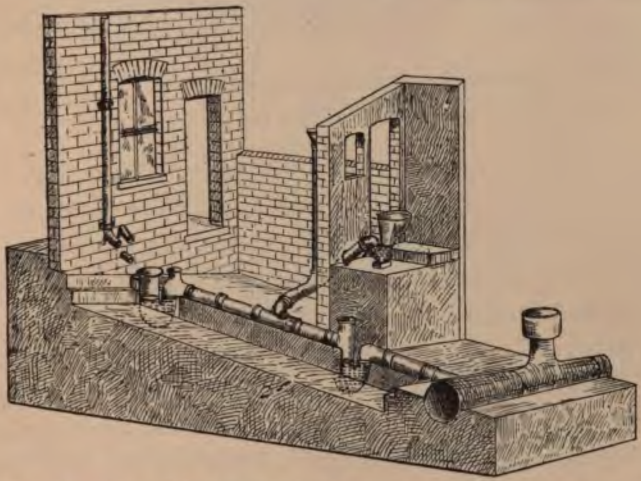

FIG. 11.—View of back yard clearly showing every pipe, gully, and trap, also the shape of the Artisan w.-c. and trap, the soil pipe entering drain, and the place where the ventilating pipe enters the soil pipe.

I will remove these two walls of the w.-c. (Fig. 11) and pour water down the pan. The water, you see, has run away into the sewer as quickly as it did down the yard drain, and the coloured water that fills the trap under the pan shows the shape to be the same as the other traps.

As I have had an exact model of a drain-brush made, just large enough for cleaning the house drain, you shall see me put it into the cleansing hole, D (Fig. 9, p. 46), as if I were really going to clean the drain; the handle being made of wire, it can be bent into any shape. To prove to you that it is necessary that pipes should be cleaned in this way, even when they only carry greasy water such as comes from a sink or a bath (for soap contains fat), I will relate the following little incident, which made me realise this fact. Our cook was cleaning the sink; she had removed the screw under the trap, and the water running out was, I noticed, perfectly clean; at the same time I observed a slimy substance hanging from the side of the pipe, which made me fear that the walls of the pipe inside were dirty. I therefore suggested that a bottle brush, which, having a wire handle, could be bent any shape, should be inserted in the hole under the trap so as to reach the top part under the grating, and then bent again so as to reach every other part of the pipe. To the cook's

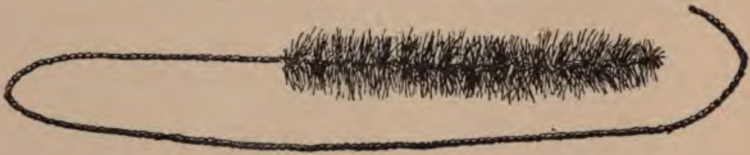

FIG. 12.—Model of flexible brush for cleaning drain pipes.

great surprise a black slimy substance fell into the pail with a very unpleasant odour, such as one often perceives coming from a sink that is untrapped. This discovery led to the bottle brush being used every week.

I selected the closet called the 'Artisan,' made by Mr. Hellyer,[1] because it is so very simply constructed, easily cleaned, cheap, and suited to a cold situation, as the water will not easily freeze, being held in the trap and not exposed in the pan. If you look you will see that it has no overflow pipe, and merely consists of a white pan, G, with an earthenware trap, H (made specially to go with it), placed above the floor line, so that should the joint, A, or place where the trap is united to the pan, get out of order, and water escape, the fact will be discovered at once, and as the floor is covered with concrete no harm will be done. The pan is left uncovered, because a lid could not prevent drain air from escaping

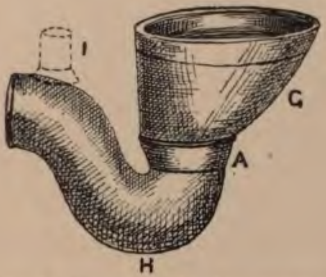

FIG. 13.—Drawing to show the simple construction of Hellyer's 'artisan closet.'

I, vent pipe to trap.

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[1] Beard, Dent, & Hellyer, 21 Newcastle Street, Strand, London.

through the trap—it would only box it up and make it more poisonous. There is no woodwork round the sides or in front of the w.-c., merely a seat that rests on the top of the pan, which can be lifted to throw down the slops.[1] A w.-c. is the best place to receive the slops, as a good flush of water can immediately be sent to wash out the trap, and carry the foul water into the sewer in the street. Water that has been used for scrubbing floors ought to be poured over a grating, which would prevent the scrubbing brush, floor cloth, soap, or scouring stones, from falling through it to stop up the trap or drain. The grating by the back door, in my model, would be the most suitable one for this purpose, as the trap beneath the grating is constantly being flushed by water from the rain sink and bath pipe. When a w.-c. is placed inside a house above a ceiling, a piece of lead (called a tray) is placed under the w.-c. and trap with a waste pipe to carry off any waters that may fall. This waste pipe must always be carried, with its end left open, through an outer wall, never be fixed into a trap or pipe that goes into a drain. This photograph (Fig. 14) shows you the model I had made of the cistern that is considered the best for a w.-c., called a syphon flushing cistern, because when the handle of the w.-c. is once pulled nothing can prevent the whole contents of the cistern from rushing out and flushing the w.-c. The cistern ought to hold four gallons of water and discharge the water at the rate of a gallon a second. Should the water run slowly it will not have force enough to clean the trap and drain. I am

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[1] Water-closets with this arrangement are made by Messrs. Doulton & Co., Albert Embankment, S.E., and by Thomas Twyford.

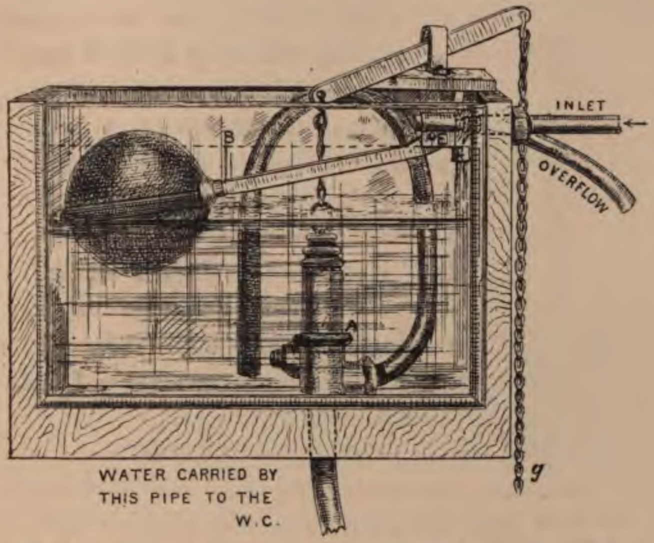

FIG. 14.—Syphon flushing cistern for a w.-c. to secure that after the handle has once been *well pulled* all the water in the cistern shall run out very rapidly—four gallons in about five seconds: the quantity required to carry the refuse or foul water out of the w.-c., and also out of the house drain, into the sewer.

The bent pipe inside the cistern is the syphon by which the water is drawn out. One end is fixed into the pipe going down into the w.-c. just below another opening into this pipe that is closed by a plug, A, suspended by a chain to a long bar. The other end of the syphon goes down to within about half an inch of the bottom of the cistern, and is left open so that water can enter it and rise up as the water rises up in the cistern until it reaches the water line B, because water always finds its own level. The rest of the syphon is filled with *air*. Directly the handle *g* at the end of the long chain is pulled, the plug A will be removed, and water will rush down the pipe to the w.-c. and draw the *air* in the syphon after it, and the water in the syphon will rush after the air to fill its place, and will continue to run until the water at the bottom of the cistern has sunk below the open end or mouth of the syphon. The ball valve is marked E.

sorry to say the model was so heavy that I could not bring it with me. Our water-closets are cleaned every week with hot water and soda and a brush like this, that is kept on purpose, and hung out in the fresh air when cleaned; but no amount of cleaning will keep a closet sweet unless a sufficient quantity of water, four gallons, is sent down every time it is used, to carry the refuse completely out of the house drain, which is often a considerable distance from the sewer in the street. People are either so ignorant or careless that the only way to secure that this shall be done is to have a flushing tank such as I have been describing.

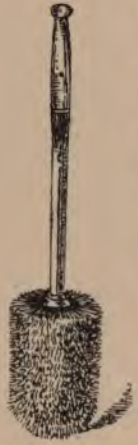
FIG. 15. — Brush to clean trap of the Artisan closet.

Before I cover up the drains I ought to mention that the Leeds bye-laws do not allow a builder to cover up the drains until they have been examined by a sanitary inspector, and proved by him to be well laid and properly united at the joints, because, I am sorry to say, workmen sometimes only fasten the top of the drain pipes well together, and leave the under part that is hidden without any cement to fasten them. This is a wicked deed, because the under part of the joint is just where the sewage and foul water would escape.

There is only one *sure* way of finding out whether a drain pipe is quite sound, and that is by fastening up the lowest end with a drain stopper,[1] and then pouring water down it through a gully or any opening at the highest part of the drain. If the drain pipe is perfectly sound and water-tight it will soon become filled, and also the gully at the top of the drain, in which the water will remain at exactly the same height; but if the pipe leaks, then the water in the gully will gradually sink and quite disappear, thus proving that the water has found some opening or leakage in the drain pipe out of which it is escaping into the soil under the yard. This process is called testing or trying a drain pipe.

Before covering up the house drain you shall see me test it as far as the gully H, Fig. 10, at the end of the yard; but instead of plugging up the drain pipe with a drain stopper I shall fill it up with a piece of cork, and then go to the top of the yard and pour water down the gully.

Now that the drain pipe and the gully at the top of the yard are full, you must watch for five minutes to see whether the water sinks in the gully below these marks to which it has risen. As we find it has not sunk in the least, we can truly state that the house drain and trap are perfectly sound. A man could not test a *real drain*, unless the gully H at the bottom of the yard were large enough for him to stand in it and plug up the end of the drain. I could not afford to make a *man-hole*, as it is called, nor would it be necessary to provide one for a cottage dwelling, when the *house drain* is placed as mine is, outside the house. But when the house drain is carried through the house, sanitary engineers tell us that there ought not only to be a man-hole at the end of the drain in the area in the front of the house, but another hole, called an inspection chamber, at the back of the house, to allow the soil pipes and waste pipes to be tested and inspected, and the house drain to be periodically cleaned and also tested, without the expense and trouble of removing the flooring in the basement, and digging up the soil under the house.

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[1] Maker, F. Bolting, 6 Baker Street, Oxford Street, W.

CHAPTER VII.

DRAINAGE SYSTEMS OF LONDON.

IN London, builders are compelled to carry the house drain under the house, because as a rule there are no back streets, owing to the dearness of building land, and therefore no back sewers. This unhealthy method of draining a house is no doubt the cause why so large a proportion of London houses are said to be in a most unhealthy state.[1]

My own experience of a London house has been a very sad one. We had not occupied our present house more than a few weeks, when we discovered that the sink water could not run away. This fact at once determined us to have all the drains thoroughly examined. After removing the whole of the flooring in the basement, and digging down to the foundation in search of the drains, a broken drain-pipe was found lying on the bare clay without any fall, and not joined to the sewer in the street, but stuck into an old brick drain nine inches square, that was separated from the street sewer by a hole three feet deep, into which the sewage fell, and had to remain until a great flush of water carried some of it into the sewer.

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[1] January 11, 1881, Mr. Cresswell stated at the Sanitary Protection Association that out of sixty or seventy thousand houses built in the metropolis, fifty thousand are unfit for habitation.

The state of things was almost worse at the back of the house, because the drain-pipe I have just mentioned did not extend so far as the part of the building that projected in which the scullery sink and servants' w.-c. stood; the consequence was that the foul water from the sink and the sewage from the servants' w.-c. ran out and remained under the scullery floor!

Before we could complete the new drainage of the house, one of my family became very ill with fever and a sore throat (called a drain throat), which ended in a long illness. Seeing that in London, the largest city in the world, and also in other places, the drains are carried under the houses, I decided to try and explain the new method (recommended by the first sanitary authorities of the day) of draining houses that can also be applied to those under which the drains are carried. This method secures the complete and instant removal of foul water and sewage, keeps the house and drinking water free from drain-air, and also provides a means for inspecting, cleaning, and testing the drains, without the cost and labour of removing the flooring or soil. As I was unable to impart this information by the aid of a model, I employed Mr. Head, of Notting Hill, to make drawings and plans of our house in [illegible], by which he was to show how this method

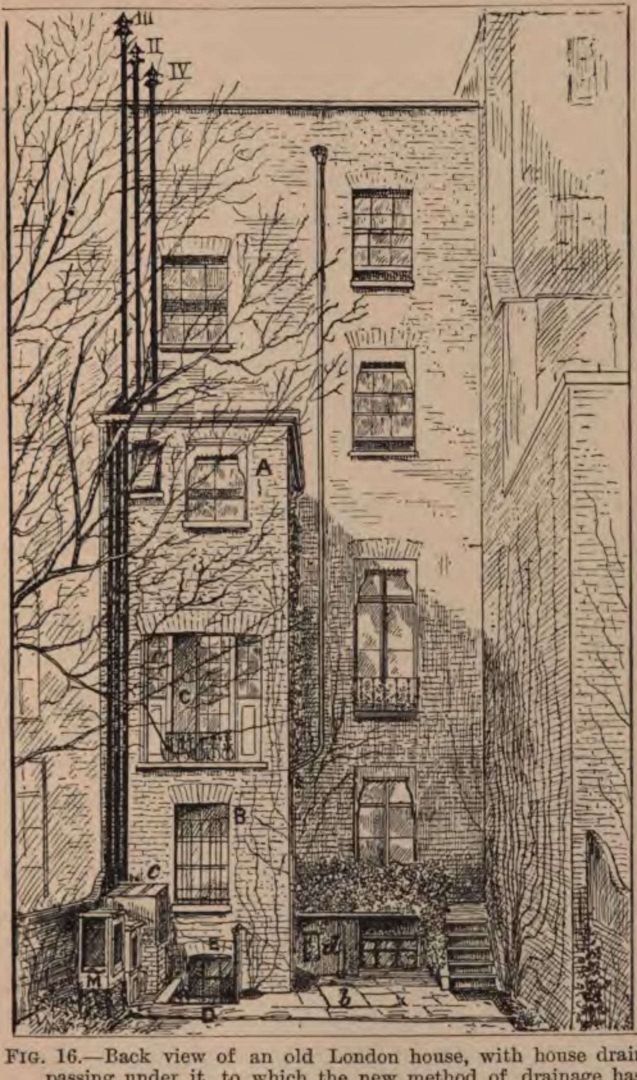

FIG. 16.—Back view of an old London house, with house drain passing under it, to which the new method of drainage has been adapted (approved by the first sanitary authorities).

c, cistern for drinking water; E, scullery door; B, w.-c. on ground floor; A, w.-c. on first storey; pipe III. vent pipe to soil pipe; II. vent pipe to house drain; IV. vent pipe to grease-trap; D, steps leading to scullery; *d*, window of servants' w.-c.; *b*, air-tight cover to inspection chamber; M, safes for food; C, window on the staircase landing.

could be adapted to a house under which the drain passed built about forty years ago.

We will first examine this drawing, that gives a view of the back of the house and a small piece of the garden. The cistern, for drinking and domestic purposes, stands on the wall to the left, and is supplied direct from the main. We shall find that all the three water-closets and the sink are placed in this part of the building that projects. The glass door, E, at the bottom of the steps, D, leads into the scullery, and close by the door stands the sink, from which the sink-pipe is carried through the outer wall into the grease-trap placed on the left in a niche in the wall. This drawing (Fig. 17) shows the construction of this trap.

The servants' w.-c. is in the basement on the right, lighted by window, *d*. Window B belongs to the w.-c. on the ground-floor, and the smaller window, A, gives light to the w.-c. on the first storey. The soil-pipe from the two upper w.-c.'s passes down the outer wall into the inspection chamber, where it discharges its contents. The entrance into this chamber is on the right of the steps, covered by an air-tight door marked by *b*. The ventilating soil-pipe No. III. is carried high away from any chimney or opening in the roof, and has the same diameter as the soil-pipe. No. II. is the pipe that ventilates the grease-trap, and pipe No. IV. ventilates the back of the house drain.[1] These pipes have each a fixed cowl at the top, to prevent the pipes from being stopped up by birds, &c. Some sanitary authorities say a ventilating pipe acts best when left open. Before we leave the back of the house I must point out the two safes, M, on the left, in which I told you we kept the meat, butter, milk, &c.

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[1] The place where pipe IV. enters the drain is shown in the plan (Fig. 18, p. 62).

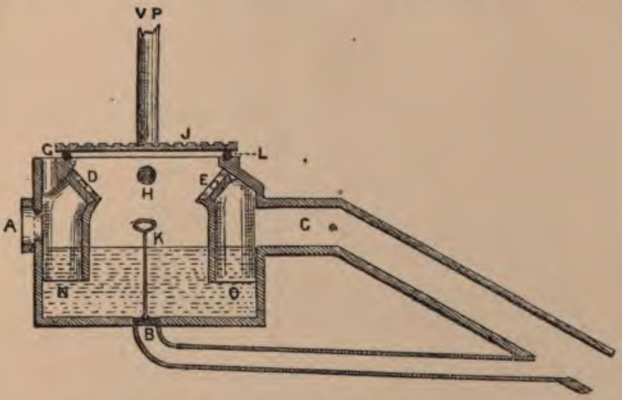

FIG. 17.—Hellyer's patent stoneware grease-trap.

Description of trap.—A large quantity of water always remains standing in this trap, enough to cover the open ends of the two pipes, N and O (placed inside at each end of the trap), with about two inches of water to prevent bad air from passing up them. The pipe from the sink is taken through the scullery wall to the left side of the trap, A, where it is fitted into the pipe (N) that carries the sink water down to the *bottom* of the trap. Directly the grease enters the cold water, it becomes solid, and rises and floats on the top of the water. The foul water (deprived of its grease) rushes across the bottom of the trap, flies up pipe O, and is then carried down straight into the drain pipe C. Pipe H is the ventilating pipe, which should be carried high up away from any opening into the house.

Directions for cleansing trap.—When the cover is removed, take an iron spoon with a long handle, skim the top of the water and put the grease on some ashes at the bottom of a zinc or iron pail; then take out the stopper D, that closes the top of pipe N, through which the sink water enters the trap, and remove the grease that collects round this pipe. (The stopper E to pipe O cannot be taken out.) After removing all the grease, take hold of the handle, K (standing up in the trap), and pull up the plug that covers the mouth of the drain pipe B, to let all the water in the trap run away, then put the plug in again to prevent drain air from coming up. When the trap has been cleaned by means of a brush and hot water and soda, pull up the plug again to let the dirty water escape. A grease-trap is a dangerous trap unless it is well ventilated and cleaned every week, because foul gases will collect inside it.

The use of a grease-trap is to catch the grease that is in the sink water before it enters the drain where it

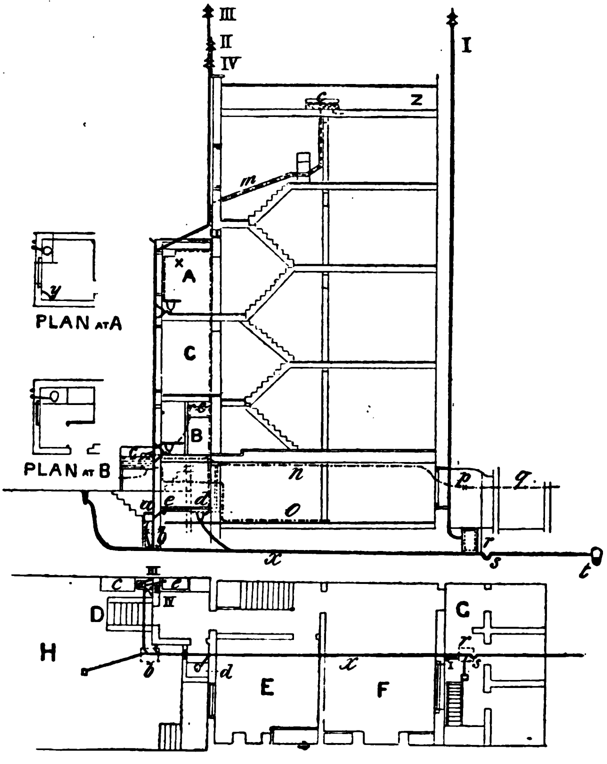

FIG. 18.—View of the interior of London house, to show position of every sanitary apparatus.

Pipe III. vent pipe to soil pipe; II. vent pipe to house drain; IV. vent pipe to grease-trap; I. vent pipe up the front of the house from the man-hole. These numbers are all repeated on the plan. *c* is the cistern in attic; *m*, water pipe in a case; A, w.-c.; *y*, slop sink, and tap of water from the main, *n*; flushing tank, x; B, w.-c. on ground floor, and the cistern, *c*, also supplies the syphon flushing cistern in the servants' w.-c., *d*, on basement; the dotted lines, *o*, show the water pipes from the cistern *c*, in garden passing to the kitchen boiler; *n*, the main water pipe; *a*, grease tank; *e*, sink in scullery; *b*, inspection chamber; *x*, house drain; *r*, man-hole; *s*, trap to separate house drain from sewer, *t*. The same letters are repeated on the plan. G in plan is the area; F, front kitchen; E, back kitchen H, garden.

would stick to the pipes, create bad air, and stop up the drain in a house where there was a great deal of cooking and washing-up to be done.

As we are now going to look at a drawing of the interior of the house, I must mention that the dotted lines in it represent the water-pipes. We will begin at the top. Here in the roof we find a cistern, *c*, the overflow, Z, from which passes through the roof and outer wall to discharge its contents into the open air. By following the dotted lines (*m*) you see that this cistern supplies the flushing tank above the w.-c. on the first storey; the tap over the slop sink in the corner of this w.-c. is fed from the main (*n*) to supply water for the bedroom bottles and jugs, and for drinking. The w.-c. on the ground-floor and the one in the basement are supplied by cistern, *c*; their overflow pipes discharge into the open air. The closet-traps and wood fittings are exactly like in principle to those I selected for the cottage dwelling. I wish you particularly to notice that a short pipe passes from the upper part of each of the traps belonging to the two water-closets (that stand one above the other) into the ventilating pipe No. IV., that ventilates the grease-trap. These little pipes supply air to the traps, to prevent the water being drawn out of one trap when the other water-closet is used. The large drawing (Fig. 19) shows this method of ventilating these traps more clearly.

Though this drawing (Fig. 18) of the interior of the house is on so small a scale, I think you will be able to see the house drain, *x*, passing under it in a straight line without a bend, so that a drain brush could be sent through it from the inspection chamber, *b*, which cannot be seen in this drawing.

The man-hole, *r*, is clearly shown in the area in the front of the house, and the ventilating pipe No. I. rising out of the man-hole passing up the front of the house. By means of this ventilating pipe, and the one at the back, No. II., which goes into the house drain, a current of fresh air will be constantly passing through the house drain.

I will now show you a large drawing of the interior of the inspection chamber, in which you can see where the soil pipe No. III. enters it, and the two pipes from the trapped gullies, E and F, in the garden for surface

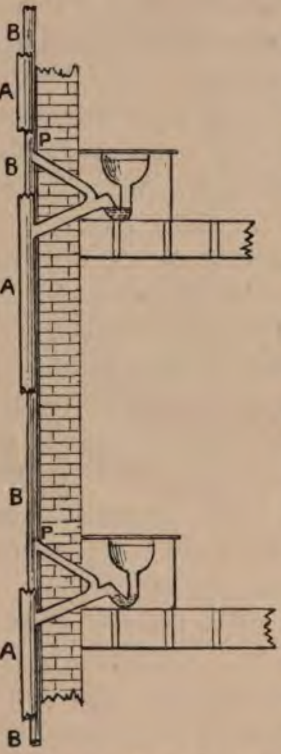

FIG. 19.—Drawings showing how the trap under a w.-c. must be ventilated when water-closets are placed one above another, to prevent the water in the traps being drawn out when the handle is pulled up of either the upper or lower w.-c.

P, ventilating pipe; B, vent pipe to grease trap.

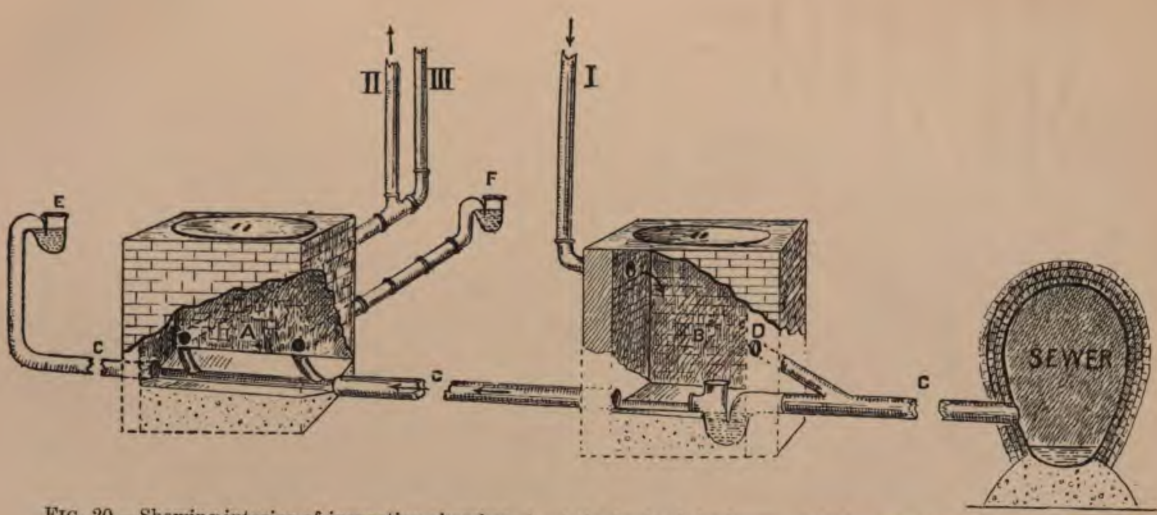

FIG. 20.—Showing interior of inspection chamber, A, at the back of the house, and the man-hole, B, in the front.

The inside dimensions of disconnecting chamber, B, to house drain, are 3′ 0″ × 2′ 6″. The walls 9″ thick all round.
Pipe II. vent pipe to house drain ; III. Soil pipe ; I. vent pipe to admit air to man-hole and house drain. The gaps, C, left in the house drain indicate that owing to a want of space the whole length could not be shown ; D, sweeping hole into drain with air-tight stopper ; E, F, trapped gullies in garden. The pipe from the grease-trap IV. could not be shown in this small drawing, but may be seen in the plan, Fig. 18, at A.

F

water, which pour their contents through half-open pipes into the open channel that runs through the bottom of the chamber, A, into the house drain. The pipe IV. from the grease-trap could not be shown on this small drawing, but may be seen in the plan at A (Fig. 18). These pipes can all be tested separately and cleaned by a drain-brush. To test the house drain the end that enters the man-hole must be closed by a drain stopper, and the water in the cistern and flushing tank must be allowed to run until the workman finds by looking through the doorway, which leads into the chamber, that the water has risen up in the chamber sufficiently high to cover the mouth of the house drain. He will then have to mark the place to which the water has risen on the side of the chamber, and watch to see whether it remains at exactly the same height; if it does so he will know that the drain is sound. The three gaps left in the house-drain marked C indicate that, owing to a want of space, the whole length passing under the house to the man-hole in the area could not be shown.

The man-hole in this picture, B (Fig. 20), is also much enlarged, and allows you to see where pipe I. enters to admit fresh air into the man-hole and into the house drain, and also the trap that comes between the house drain and the sewer in the front street: this trap can be inspected and cleaned.

When the drainage was completed five years ago, I requested to be furnished with drawings of the house (similar to those you have just seen), showing the position of every pipe; and also drawings showing the structure of every apparatus. These have enabled me to teach our servants how to clean them, and to understand the necessity for carrying out the written rules I give them,[1] and the danger of stopping up the traps and house-drain by careless acts and the slovenly way in which house-work is so frequently done. Of this I will give you the following example. We were staying at a seaside place near Leeds, where a large family had taken a gentleman's house known to be very well drained. The mother soon became ill, the children and servants had sore throats, and the eldest son typhoid fever. Directly Mr. Wheelhouse of Leeds arrived, he said the sickness was entirely caused by drain air, and ordered the family to return home at once. The drains were examined, and one of them was found to be completely closed by two or three dish-cloths that a servant had thrown down when emptying her bucket.

Pieces of hair thrown down a w.c. will gradually unite and form into a hard ball large enough to stop a drain-pipe. A relation of mine told me that one of his drains was once completely stopped up in this way by a ball of hair. Every dressing-table should have either a basket or little bag to receive the hair, which ought to be burnt. It is a common practice to leave a water-closet unused for a long time, but this is very dangerous, because in time the water in the trap dries up, and leaves the pipe open for drain air to escape. Some sad stories could be told of illness caused by the closing of a w.-c. without first removing or sealing up the soil-pipe, so that no drain-air could escape. Servants left in charge of a house when the family are from home should flush every w.-c., bath, sink, and lavatory once a week, because each of them will have a trap that may go into a drain. I am sorry to say there is a w.-c. called a pan closet, more used than any other kind of closet, which is the cause of a great deal of sickness and drain complaints. I have brought a picture of one (Fig. 21, page 69), by which you can see that instead of having only one pan resting on a syphon trap like the 'Artisan,' it has no less than three pans, which rest on that dangerous trap I have described called a D trap. The bottom of the first pan is closed by a movable pan that is drawn aside by the handle when it is raised. If you look you will see that the third pan and the D trap are very filthy, and that sewer gas has eaten holes through the top of the D trap. To make matters worse, two pipes go into the D trap, one coming from a cistern of drinking water, the other from a bath and a housemaid's sink. Many cases of typhoid fever have been caused by D traps and pan closets.

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[1] See page 141.

After all you have heard of the dangers that arise from water-closets, you will think, as I have often done, that it would be better to have what people had in former days, closets outside the house, that are emptied out and cleaned, called privies. During our stay in that

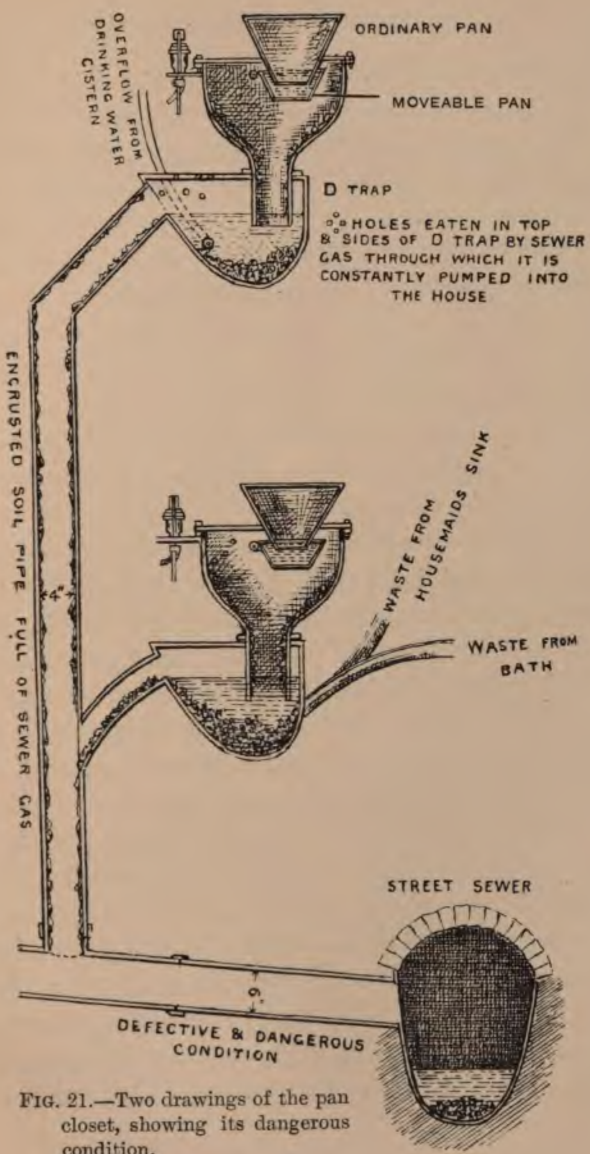
ORDINARY PAN
MOVEABLE PAN
OVERFLOW FROM DRINKING WATER CISTERN
D TRAP
HOLES EATEN IN TOP & SIDES OF D TRAP BY SEWER GAS THROUGH WHICH IT IS CONSTANTLY PUMPED INTO THE HOUSE
ENCRUSTED SOIL PIPE FULL OF SEWER GAS
4"
WASTE FROM HOUSEMAIDS SINK
WASTE FROM BATH
STREET SEWER
6"
DEFECTIVE & DANGEROUS CONDITION

FIG. 21.—Two drawings of the pan closet, showing its dangerous condition.

house near Leeds that you remember had a dummy cellar, I gained a great deal of experience about these outside closets, and found they too could become very dangerous to health, owing to the uncleanly way in which they are kept, their bad construction, and because sanitary authorities do not make provision for their being regularly and frequently emptied. A most offensive smell led me to examine the closet in the back garden, when I found that the place behind to receive the sewage, which had not been emptied for two months, was an open cesspool used also as a midden, into which decaying vegetable matter, cinders, and ashes, were thrown. The sides and bottom of the cesspool were built, as they were in old times, of loose bricks, through which the foul liquid escaped into the soil. After discovering this I sent for the inspector of nuisances, who had the cesspool and the privy also properly constructed according to the Leeds building bye-laws, which require that the receptacle at the back shall be water-tight (lined with cement), roofed, and well ventilated, and that the privy shall have a thorough current of fresh air.

The inspector also had the drain that passed down the garden relaid, and a special grating near the privy provided for receiving the slops. Nothing but ashes should be thrown into the receptacle behind the privy, because ashes and sewage form an excellent manure that farmers will willingly buy; but the sewage becomes useless to them if *cinders*, slops, or animal and vegetable matter are added to it. I regret to say that the Leeds

Corporation find that a great many people are so dirty in their habits that they will not even take the trouble to empty the slops down the grating specially provided, but empty them by the back door, or on to the yard pavement, or into the ashpit. The Corporation have therefore laid a fine on those who commit these nuisances. On the other hand, the people complain with truth that their privies and middens are often not emptied for a considerable time. Whenever this neglect occurs, your parents should immediately do as I did, send for the inspector of nuisances; and they should also take care to give their votes at the municipal elections to men who they know will consider all matters relating to health of the first importance.

If I possessed a cottage with garden and a little land in the country, I should try the earth-closet system. An earth closet, as shown in this picture, consists of a seat and pan, with a receptacle at the back for holding ashes and dry earth. When the handle is pulled up the contents fall upon the refuse and purify it, because you must know that ashes and powdered earth hold a great deal of that wonderful oxygen gas that purifies and changes all it touches. I should use the soil made by the ashes and

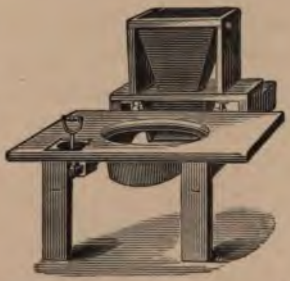

FIG. 22.—Drawing of an earth closet (Moule's).

sewage for my own land and garden, as this soil is said to be very valuable for garden purposes. Whichever of the three methods I might adopt of carrying away the sewage, a house drain would still be required to carry away the slops, the water from the sink and bath, and rain water, similar to the drain I carried down the back yard of my healthy dwelling. But as there would not be a sewer in the country, the drain would first have to discharge its contents into a tank, where it could be purified by lime or some disinfectant, and then be carried into a surface drain, or into a stream of water not used for drinking. The Leeds Corporation manage the drainage of the borough, and no sewage is allowed to enter the river Aire, on which the town stands, until it has been purified. A big drain, called the main sewer, ventilated every fifty yards, carries the sewage from every w.-c. to Knowsthorpe, two and a half miles from the Leeds Town Hall, where large sewage works have long been erected to purify the sewage. The solid part of the purified sewage is sold as manure. The main drain now measures above 130 miles.

CHAPTER VIII.

DISEASES CAUSED BY IMPURE WATER.

YOU will be surprised to hear that so little was understood about the danger of drinking impure water, that only a few years ago the sewage and drainage of all towns was carried into the rivers which supplied the inhabitants with drinking water, and also supplied the villages and country places through which these rivers passed. When it was found that the terrible disease called Asiatic cholera broke out in these places, and wherever the people drank impure water, an Act of Parliament was at last passed in 1876 to make it illegal to empty filth or sewage into rivers. But alas! in spite of this Act, sewage and filth are still thrown into streams and rivers, and people have to drink their poisoned waters. Water taken from a well or pump near a large town, a drain, cesspool, or a churchyard, ought not to be used for drinking or domestic purposes, because the sewage from the drain or cesspool, and the organic matter from the graves, may pass through the earth and find its way into the well.

In 1854 the cholera was very bad in Golden Square, in London, where it was found that the people who lived in the neighbourhood had procured their drinking water from a well near a churchyard. It is now thirty years since cholera was last brought to England from the East. During these thirty years doctors and scientific men have been trying to find out what causes this terrible disease, in order to be able to prevent it from spreading, should it again make its appearance in this country. You will be interested to hear that this year (1884) a doctor has discovered that cholera is caused by a poisonous living creature called a 'germ,' so small that it can only be seen by the most powerful microscopes. This discovery was made by Dr. Koch (a German), who went this year (1884) to visit a district in Calcutta where the cholera had broken out. On finding that all the people who had been seized with cholera had drunk water from a dirty pond or tank (also used to bathe in), he examined the water, and found that it was swarming with germs exactly like those he had found in people who had died of cholera; in addition to this fact he also found that directly the pond was cleaned, and the germs had all disappeared, those who drank of the water no longer took the cholera, and the disease entirely disappeared from the district.

Since Dr. Koch's return from India in March he has been engaged during the summer (1884) in watching another outbreak of cholera in the south of France. As it is expected that this terrible disease may again appear in England, I think it is our duty to try and benefit by Dr. Koch's great experience, and follow the advice he has given the public, so that we may know how to protect ourselves, as he has done, from taking the disease, save ourselves from senseless fear, and be able to assist in preventing its spread by understanding the nature of the food on which the cholera germ grows. Dr. Koch tells us that the cholera germ grows in liquid foods that contain animal or vegetable organic matter, such as sewage; also in impure liquids that come from uncooked vegetables or meat; and in the dirty water from clothes taken off a person who has died of cholera. Boiling heat (212°) kills the germ; the doctor therefore begs that people will not drink any water until it has been boiled, nor eat any *kind of food* until it has been well cooked. As the cholera germ can penetrate through the skin, Dr. Koch always took the precaution to wash his hands after having examined dirty water or anything that might contain the germ. Fresh air (or the oxygen gas it contains) destroys these germs, reduces them to dust, so that they do no harm when they get into the lungs: they are also found to perish when exposed to dryness, as they can only grow in a liquid substance.

This information teaches us that cholera is a preventable disease, and would soon disappear from a place where people had cleanly habits, a plentiful supply of pure water, and good drainage; and where women did their part, namely, kept the house clean, saw that every room had a constant supply of fresh air night and day, and took care that the food was well cooked and the water boiled. With regard to the poor, everything should be done to make it easy for them to keep their homes healthy, and to enable them to provide a sufficient supply of wholesome food, because those who live in bad air and are underfed easily take cholera or any other preventable disease. On the other hand, it has been found that cholera attacks and proves fatal to people who are intemperate and overfed. 'Precautions against the Spread of Cholera,' written by Mr. Wheelhouse, F.R.S.A., of Leeds, see page 149.

I am sorry to say impure water causes a great many terrible diseases besides cholera, such as diphtheria, diarrhœa, typhoid fever, &c. Seeing that the drinking water in London is often kept in uncleanly, badly constructed cisterns, which admit drain air, I think every one, and especially women who manage the house, ought to understand enough about the way a cistern is made to be able to find out whether drain air can enter it, and by what means it can be kept out. Every one ought also to know how a cistern should be cleaned. The glass model of a cistern for drinking water which you see on the little stand has been made purposely for me to give you this information. I must first tell you that cisterns are never as a rule filled quite full, the water being only allowed to rise up to within one or two inches of the top. The place to which the water rises is called the *water-line*, marked on my cistern with a line, D.

This pipe A on the left is an overflow pipe, and if you look into the cistern you will see that the opening that leads into this pipe stands just above the water-line. Pipe H, coming from the bottom of the cistern, carries water to a kitchen boiler, sink, &c. The pipe C, in front of the overflow pipe, brings the water to the cistern, and is called the service-pipe.

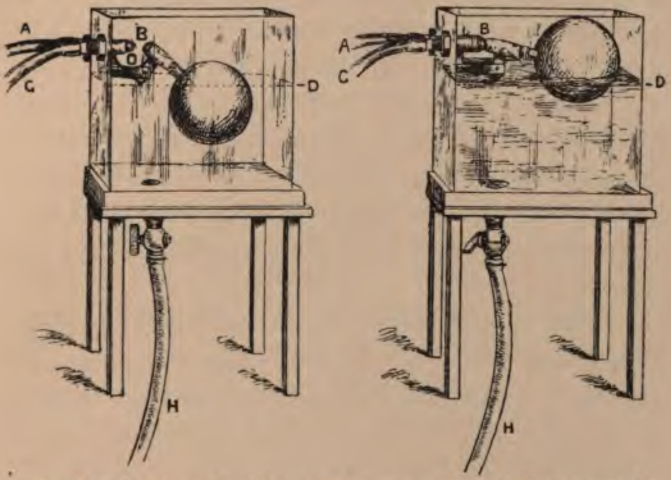

FIG. 23.—Glass model of a cistern to supply a boiler or tap for drinking and domestic purposes.

Cistern 1 is empty, cistern 2 full; water-line, D; overflow pipe, A; service pipe, C; ball valve, B; just under the letter B is the door or valve, O, that admits water into the cistern; H is the pipe that carries water to either a boiler or to the tap over the sink.

We will examine the cistern (I) while it is empty, as this is the time when you can see the opening, O, in the service pipe, through which the water runs into the cistern.

This piece of iron with a ball at the end of it forms what is called a ball valve (valve means a door). I will now pour water into the service-pipe C through this funnel, when you will see that as the water rises the ball will float on the top of it, and gradually place the end of the piece of iron B, covered with wash-leather so that it will completely close the entrance O, and prevent any more water from passing down it into the cistern. We will now let all the water run out of the cistern through the pipe H, when you will see the ball valve gradually sink down with the water until it has opened the entrance O, through which the water runs into the cistern. There are several kinds of ball valves; one of the strongest is to be seen in my model of a flushing cistern for a water-closet (Fig 14, page 53).

This ball valve, B, was made on purpose for my glass cistern, and would not be sufficiently strong to close the opening O that admits water, in case the water were to rush into the cistern with great force from a great height.

Now suppose, as sometimes happens, that a ball valve in any kind of cistern were to get out of order, and be unable to rise and close the water entrance O, the water would then flow over the top of the cistern unless an overflow pipe, A, such as I have provided, were placed above the *water-line* ready to receive it. A cistern is generally provided with an overflow pipe; but this pipe, as I told you before, is often, alas! taken down into a drain or sewer, when the drain air will, of course, be constantly flying up into the cistern, and also into the house if the cistern stands inside it. The only way to prevent sewer gas or drain air from entering a cistern is to carry the end of the overflow pipe, as I did in my healthy dwelling, through an outer wall, where the water can run into the open air.

In some places—London, for instance—the water for drinking and for every purpose is kept in cisterns. Our small house in London, as you will remember, possesses no less than five cisterns—one for drinking and domestic purposes, one to supply the kitchen boiler, and a separate one for each of the three water-closets. Cottage houses in London, I was told, have generally only one cistern for drinking and every purpose. In order to assure myself of the truth of this terrible statement, I paid a visit to a house in a row occupied by a very respectable family of working people and their lodgers. After finding that all I had heard was only too true, I took a sketch (from which this picture is made) (Fig. 24, page 80) of the little kitchen and the washhouse and water-closet, that projected into a tiny back yard. The cistern, A, was placed on the washhouse roof, just at the end of the kitchen, from which was carried a pipe (the pipes are all shown by dotted lines), to the sink tap that supplied the drinking water; the pipes, C, *g*, and H, carried water to the boiler and sink in the washhouse, and to the W.C., E. The overflow pipe B, shown by dotted lines, passed down the wall of the washhouse and entered the drain in the yard. This pipe B, being always open at the top, would of course convey a constant supply of drain air into the cistern and into the water.

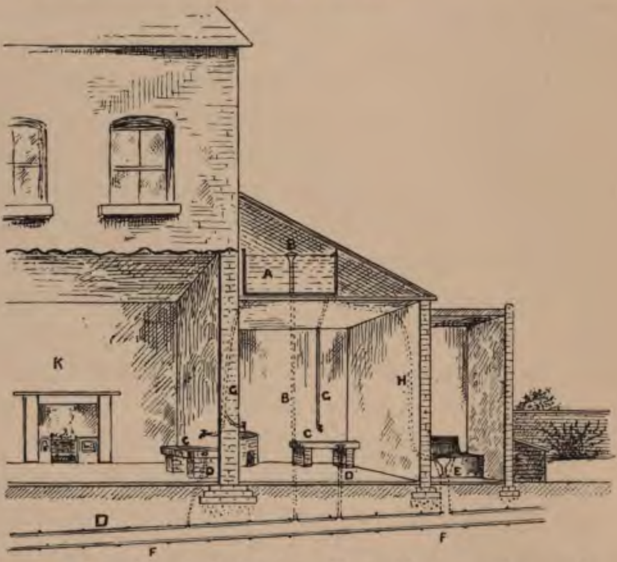

FIG. 24.—Drawing of the kitchen, K, washhouse, and w.-c., in a working-man's cottage in London, to show how these houses are sometimes supplied with only one cistern, the overflow pipe from which is carried straight into a drain.

A, cistern on washhouse roof; B, overflow pipe passing down washhouse wall to drain. Pipes C, D and G, carrying water to the sink and boiler in washhouse; pipe H going to the w.-c.

A gentleman told me he had often seen sewer gas bubbling up through the water from the overflow pipe in the cisterns of cottage houses in London, and that a hole was left in the lid to let the gas escape. To make matters worse these cisterns are often only filled once or twice in twenty-four hours! The only plan with water of this kind is to boil it and let it get cold before using it for drinking or domestic purposes, because nothing but *boiling heat* (212°) will, as I have told you, kill germs of disease. Some people have an ignorant idea that a filter will kill germs of disease, but no filter can destroy them. Filters are also very dangerous, because they are very difficult to clean, and when dirty are said to breed poisonous germs, and cause typhoid fever, diphtheria, small-pox, &c.

You shall now learn how to clean a cistern by seeing me clean my model (Fig. 23, p. 77). The first thing to be done is to close the opening O, through which the water enters the cistern, by very gently raising the ball valve as high as it will go. To do this I must tie this strong piece of string round the handle close to the ball, and then fasten the string round something above the ball valve so as to keep it up: the service-pipe C will do very well. Now that the door O is shut, and there is no danger of water rushing into the cistern, I will clean the sides and bottom of the cistern with this brush, then mop up the dirty water with a cloth lest it should stop up the tap, and wipe the cistern with a clean linen cloth, not a flannel one, as the flannel comes off. Those who have once seen a cistern cleaned, and felt how slimy and dirty it becomes, will, I am sure, take care that their cisterns are cleaned at least twice a year.

A cistern ought never to stand in a dark place, or where it cannot be easily examined and cleaned. Cisterns made of galvanised iron are considered the best, as they are wholesome and not expensive. Lead cisterns are dangerous, as lead mixes with the water.

Kitchen boilers ought also to be cleaned once a year. Some kitchen boilers are filled by pouring water into them, but our boiler is called a self-feeding one (Fig. 25).

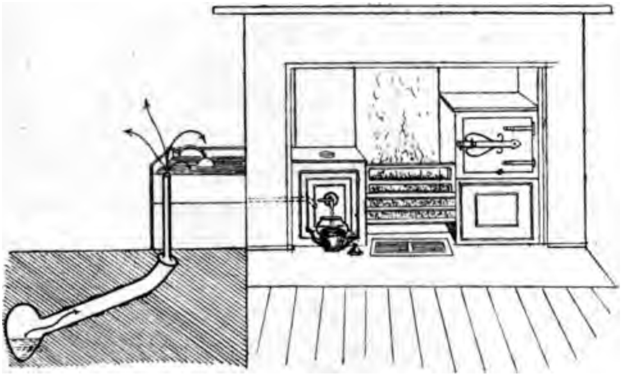

FIG. 25.—Cistern feeding kitchen boiler with overflow going direct into drain. (Taken from 'Dangers to Health,' by T. Pridgin Teale, M.A., of Leeds.) This boiler is called a self-feeding boiler.

This name is given to it because when water is taken out of it a fresh supply runs in, until the water in the boiler has risen to the same height as the water in the cistern that feeds the boiler, owing to the fact that water always finds its own level: for example, if the water in the cistern were to overflow, owing to some accident to the ball valve, the water in the boiler would overflow too, if the top of the boiler was on the same level as the top of the cistern.

The first time our kitchen boiler in London was cleaned I was present, and saw to my horror that there was a muddy sediment at the bottom of it at least three inches deep. This unpleasant fact immediately brought to my mind Mr. Teale's picture (Fig. 25, p. 82) of the tea-kettle being filled from the kitchen boiler—a very dangerous as well as a dirty practice, because, as Mr. Teale's picture shows, these boiler cisterns may have an overflow pipe going down straight into a drain.

Our boiler cistern is a very small one, and stands in a cupboard by the side of the fireplace. A boiler can of course only be cleaned after the kitchen fire has gone out, and the water has become cold. Before the cook cleaned our boiler, she first tied up the ball valve in the cistern, then she ladled out some of the sediment at the bottom of the boiler, and cleaned the sides with a brush. After this she mopped up with a linen cloth all the water that rested below the tap, then untied the ball valve in the cistern, and allowed the clean water to run into the boiler. I hope you will not forget that a boiler will burst if cold water is poured into it when it is hot.

Before we say good-bye to my glass model I must ask you what you would do in case the ball valve in a cistern were to get out of order, and be unable to rise and prevent the water from rushing over the sides of a cistern, and causing what is called an overflow. I am sure you will all say, 'We should do as we saw you do before you cleaned the cistern, tie a strong string round the handle near the ball, and gently lift it up until the water ceased to run out, and then fasten the two ends of the string round something above the ball valve to keep it up.' To prove how important it is that women should know how to act in case of an overflow, I will relate the following fact. A cook left in charge of a London house saw, to her horror, that water was rushing over the sides of a cistern placed inside the house. Not knowing what to do, she became so frightened that she could think of nothing but rushing off to tell her master. She therefore locked up the house and drove off in a cab to his office, which was a considerable distance from the house. You may imagine the terrible state the house was in on their return.

I am rejoiced to say that in Leeds the water for drinking and domestic purposes is not kept in cisterns; cisterns are only used to supply baths, boilers, and water-closets. The Corporation have the management of the waterworks in Leeds, and carry a constant supply of excellent water at a small rate into every dwelling in the borough by a pipe called the main, to which there is a tap. A house such as my model represents, rented at 5*s.* 6*d.* a week, would only pay a water rate of 10*s.* a year, and no extra charge would be made for the bath water.

CHAPTER IX.

WARMTH AND VENTILATION.

HAVING shown you that my model has all the requisites for health I said it should possess, I will now give you the information I promised on warming and ventilating a cottage dwelling by simple and economical means, and offer a few suggestions as to furnishing it, so that it may be kept clean and healthy with as little labour as possible, and may look cheerful and pretty at a small cost.

My healthy dwelling is to be warmed according to the good old English plan by open fire-grates. English people prefer open grates to closed stoves for the following reasons: an open fire helps very greatly to ventilate a room, because the heat draws cold fresh air from every opening to feed the fire, and the open chimney allows the bad air to escape; the heat also which comes out of an open grate is of a healthier kind than the heat that has passed through the walls of a closed stove. The rays of heat from an open fire spread directly through the room, and warm every object they touch—walls, ceiling, furniture, people, &c.; but, strange to say, they do not in the least warm the air as they pass through it. The air is gradually warmed by the heat that is given out from every object that has been warmed. As the fire in a stove is shut up, the rays of heat cannot get out without first passing through the walls of the stove, and by passing through an object the heat is changed, so that it has only the power of warming the air, which in a room soon becomes dry and close.

The sun is an open fire, and its rays, like those from an open fire, spread out and warm every solid object, but not the air. For this reason the air is always intensely cold at the top of a high mountain covered with perpetual snow, on which there are no solid objects to be warmed by the sun's rays; while at the bottom it may be intensely hot, owing to the heat given out by the trees, houses, animals, and other objects in the valley; and the warmed air then melts the snow and leaves the earth uncovered, so that the sun's rays can enter it. Snow, you know, is a non-conductor of heat, which therefore cannot pass through it. The sun's heat also creates ventilation, and causes the winds to blow over the face of the earth, and carry fresh air into every dirty hole and corner it can enter.

To secure thorough ventilation, summer and winter, by simple and inexpensive means, the house must be a through house, like my model, with doors and windows at the back as well as front; it must have an open fire-grate and chimney in every living-room, and windows that open top and bottom, with a space between the middle rails (Fig. 32, p. 109) to admit a constant supply of pure air day and night, summer and winter. To prove to you how necessary it is that every living-room should have a constant supply of fresh air, I will give you the following facts. It is calculated that one person requires 3,000 cubic feet of fresh air every hour; that means the quantity of fresh air that would fill a room twenty feet long, fifteen feet wide, and ten feet high; a sperm candle requires 1,500 feet, an oil lamp 3,000 feet, a gas burner 20,000 feet, and a fire (whether open or closed, I suppose) 150 cubic feet in a minute, or 9,000 feet in an hour. At the end of that time the air would become impure, owing to the oxygen gas it contained being used up by either the man, fire, or lights.

Those who desire to make a room thoroughly sweet and healthy, especially bedrooms, workrooms, and schoolrooms, must not be contented with merely providing an inlet for good air and an outlet for bad air, such as I have described, but they must also see that during the day windows are open top and bottom, and a current of air allowed to blow through them by opening opposite doors and windows. This current of fresh air, or the oxygen gas it contains, will not only purify the air, but will purify every object in the room, the ceiling, walls, carpets, furniture, &c., and destroy the organic matter that comes from the breath, perspiration, and clothing of human beings. This organic matter will of course mix with the air and dust that is constantly descending and covering every object. Organic matter, you must remember, is the food upon which vermin and living germs feed, therefore every care should be taken to remove the dust from every living-room, and especially out of corners where it can collect. Ever since I have understood the nature and value of fresh air it makes me very sorry to see people doing all they can to keep it out of their houses, as if it were poison, placing sand-bags over the middle sashes of their windows, which are rarely open, covering the front of the fireplace, stuffing bags up the chimney, and so filling up every crevice through which fresh air can enter or bad can escape.

Some time ago our servants complained that a great deal of cold air came through the keyhole of their bedroom door, and said that they intended to keep it out by filling up the keyhole with cotton wool. On hearing this I endeavoured to make them understand that the cold air rushed through the keyhole because the room did not contain a sufficient supply of fresh air to feed them, and I related the sad fate of two young sailors who determined one night they would close every crack in their cabin to keep out the cold, and in the morning were found dead. To prove that the simple and sure way to cure a draught was to admit the fresh air that was needed, I opened the window at the top, closed the door, and held the flame of a lighted candle in front of the keyhole, as shown in this picture (p. 89), taken from Mr. Teale's book, when, to their great surprise, the flame went up quite straight, showing that no air came through the hole; but directly the window

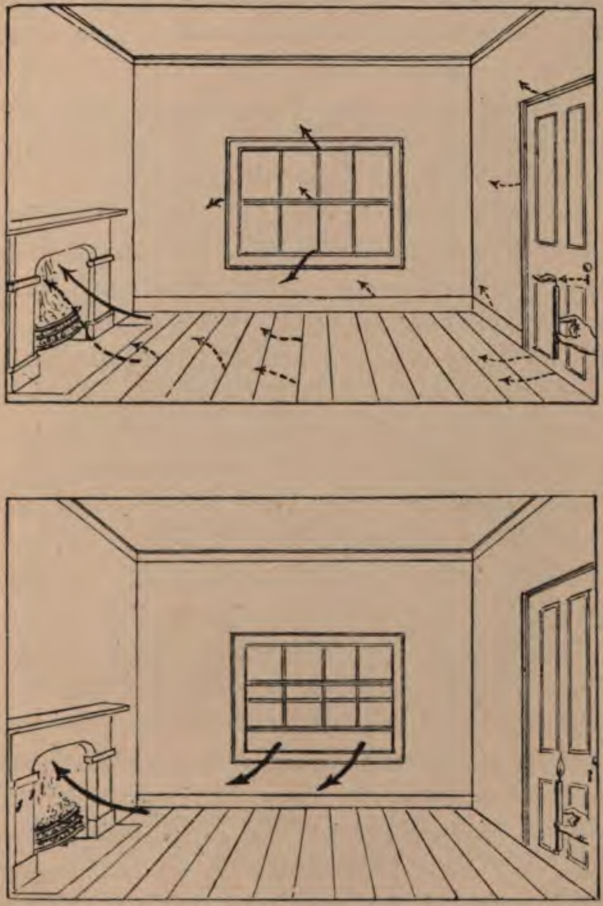

FIG. 26.—Flame of candle at the keyhole, and the lessons it teaches. (Taken from 'Dangers to Health.')

was shut the air rushed in as of old, and blew the flame into the room and nearly out.

Soon after this little occurrence I had a piece of wood, A (p. 109), put under the bottom sash, so as to raise it and leave an opening in the middle of the window, an arrangement which pleased the servants very much, because it prevented any draught from the keyhole.

In lodging by the sea-side or any health resort where the drainage is often, alas! very bad, it is a comfort to be able to satisfy oneself by the flame of a candle that the supply of air in a bedroom does not come from the house, but through the window. A chimney often smokes because the fire is not getting a sufficient quantity of fresh air (or oxygen gas) to make it burn brightly, and cause a current of hot air to fly up the chimney and carry off the smoke; when there is very little heat in the fire the cold air comes down the chimney, and blows the smoke into the room.

I will now show you this picture (p. 91) of the open grate, which I should like to put into the living-room of my healthy dwelling, made by Mr. Tennant, ironmonger, Briggate, Leeds. It is only an ordinary cottage range without any steel about it, fitted up according to my directions with an oven, boiler and tap, a hook to suspend a pan or kettle over the fire, and a simple contrivance called an 'economiser,' invented by T. Pridgin Teale, M.A., F.R.C.S., of Leeds, which I find, after two years' experience in our own house, saves coal, a great deal of labour, dust, and dirt; increases the heat and cheerfulness of the fire; and lessens smoke. This picture is from a photograph of the grate. The economiser is the piece of iron (marked A) which you can see is hooked

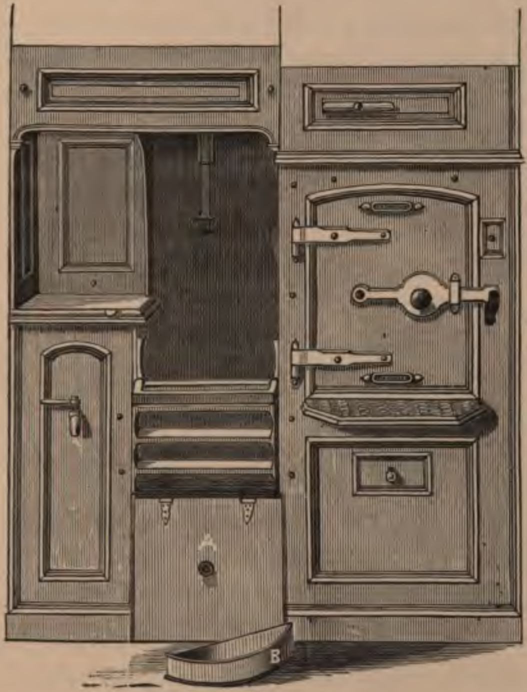

FIG. 27.—Drawing of a cottage range fitted up with every convenience, provided with an Economiser, A, that saves coal, and lessens smoke, dust, and labour.

B, is the ashpan drawn aside to show that the bottom of the economiser rests upon the hearth stone.

on to the lowest bar of the grate, and fits so closely that it completely shuts up the place under the fire where the ashes fall, which, unless they are removed two or three times a day, cause a hearth to look very untidy and cheerless.

This little model of an empty sitting-room grate has an economiser, which I will remove to let you see the open place under the fire, and the bars, called the grid, at the bottom of the grate, through which the ashes fall. I am sure you will agree with me that the grate looked better and the hearth much more tidy and comfortable when this open place was covered by the economiser. This open place is not only unsightly, but is the cause of a great deal of coal being wasted, because cold air is constantly rushing into it, and passing up through the grid on which the fire rests and then into the fire, thereby lowering the heat in the fire, so that it has not strength enough to thoroughly burn up the different substances the coal contains; the unburnt substances, therefore, fly up the chimney in the form of smoke, to pollute the air we breathe, and soil everything it touches. On the other hand, when the place under the fire is shut up by an economiser, the air inside it becomes so very hot that I find it will roast chestnuts and potatoes like an oven, owing to the heat retained in the bricks that partly enclose this place, and the hot ashes that fall from the fire.

As the ashes are useful in storing up heat, we only remove them away when the space under the grate is full. The ashes, owing to their being free from cinders and very fine, do not require the dirty process of sifting and also occupy a very small space. The space under our kitchen grate and dining-room becomes full in a week; the ashes are therefore only removed once a week, the day the dustman comes. In the drawing-room they are taken out twice a week, because the space is small. No wonder that we now find much less dust on our mantel-pieces, ornaments, and furniture, and that our rooms require to be less frequently swept; for nothing causes so much dust and dirt as the removal of ashes and the sweeping up of the hearth two or three times a day, to say nothing of how much this dirty work soils the dress and person of the servant who has to do it. Our kitchen flues were formerly swept every week, and now only once a fortnight, because less soot is made.

Seeing that fire-bricks and tiles retain a great deal of heat, and iron very little heat, a fire-grate ought only to have just the amount of iron that is necessary to hold the fire, and be surrounded by fire-bricks, like the grate in this picture (Fig. 28), which represents the one in our dining-room. This grate, when we took the house, had a deep border of raised ornamental ironwork, which was very ugly, difficult to clean, and impossible to keep free from dust. The ironwork was all removed except the front bars and the grid upon which the fire rests. The vacant place left by the removal of the iron was filled up with fire-bricks, and then covered with yellow tiles. The economiser E is made of iron. An iron grate and economiser like this would cost very little, and be very suitable for a bedroom. Every grate in my healthy dwelling is to have an economiser (*see* Fig. 2, p. 13). The comfort of an economiser in a bedroom, especially when there is sickness, is of course very great, as it lessens noise and dust. When it is desired to keep a fire in for a long time without putting on fresh coal, or to keep the room cool, the whole of the front bars must be covered by a second economiser, constructed like the one that covers up the space under the grate E. Our cook always covers over the front bars of her kitchen fire with the second economiser in

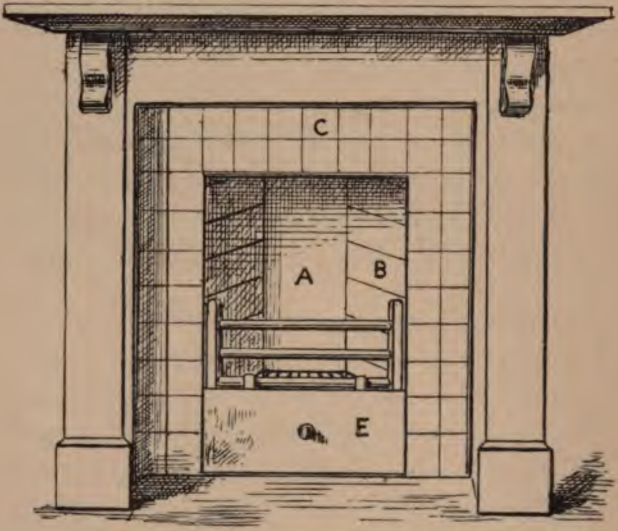

FIG. 28.—Dining-room grate with an economiser.

E, economiser; C, yellow tiles; A and B, fire bricks.

the summer when she wishes to keep the room cool, or when she has to stand over the fire either to grill, fry, or stir food in a pan. She also finds that the water in the kitchen boiler will keep hot until the morning by this means; of course every damper except the boiler damper must be closed.

An economiser can be fitted on to an open grate of any kind; the cost will depend on the shape of the grate, and the material used. For instance, I paid 3*s.* 6*d.* for an iron one for a cottage range, and 15*s.* for a brass economiser. In some grates it is found best to hook the first economiser on to the lowest bar, as in the kitchen grate (p. 92), or to make it cover the space by letting it stand against the lower bar propped by two legs fixed inside. Where earth-closets are used, the very fine ash that falls through the grid would be most valuable, and should the economiser ever come into general use the number of dustmen's carts now required would then, comparatively speaking, be few in number. As a proof that an economiser reduces the ordinary consumption of coal, I will mention the fact that since about half the fire-grates in the Leeds Infirmary have been fitted up with them there has been a saving of about sixty tons of coal per year.

CHAPTER X.

FURNISHING A COTTAGE.

WE must now leave the subject of warming, and consider the most healthy, economical, and sensible way of furnishing a cottage house. I think the best plan would be to begin by buying only the most necessary things from respectable shops that do not advertise cheap goods, and then employ a good joiner or carpenter to make strong, suitable, and useful articles, free from senseless ornament for dust to lodge in. A good joiner will take care that the wood he uses is dry and well seasoned. Deal is a carpenter's term for the ordinary inexpensive pinewood, used for the woodwork in houses, furniture, and kitchen utensils. Very fine timber trees belong to the pine family, whose names you will know: larch, cedar, yew, also Scotch fir, from which we get yellow deal, and pine wool prepared from the leaves, considered good for rheumatism, and used for stuffing cushions, &c. Norway spruce, which is a white wood, is used to make table-tops, kitchen utensils, &c. These trees also give us resin, turpentine, tar, pitch, &c. Pitch pine is a very strong wood, and beautifully figured or flowered. Pine trees, I am glad to say, are found in every quarter of the globe.

During the last thirty years very bad furniture (called cheap) has been made for the working classes and people of small means in large towns, especially in London, where house-rent is very high and labour very dear. The deal, from being used before it is dry or seasoned, soon begins to shrink, then cracks appear, openings are left between the wooden planks that cover the floors, doors do not shut properly, drawers will neither come out nor go in, and locks become useless. If you examine well-made furniture you will find that the different parts fit into each other so perfectly, that no nails and scarcely any glue are required to keep them firmly together; but in cheap furniture the parts are nearly all nailed and glued together, like dolls' furniture. Ornamental work, instead of being done in the wood, is just glued on, and breaks off with a good rub. As neither use nor comfort is considered, the shapes are bad; chairs, for instance, have narrow seats and uncomfortable backs which give no support, and thin twisted legs that have no strength in them. Sofas are made on the same bad principle, with narrow padded seats, on which it is impossible to find rest. In order to hide the unseasoned deal and bad workmanship, the surface of the wood is veneered—that is, covered over with thin leaves of expensive hard woods glued on, such as rosewood, mahogany, walnut, &c.; when a piece of this sham covering falls off an ugly bare place like a wound is left. Another false method employed is to paint the deal so that it may resemble oak, rosewood, mahogany, &c.

I am sure you will think with me that the furniture I have described would be dear at any price. Deal, when it is well seasoned and dry, can be made into excellent and inexpensive furniture of every description (except chairs), because, owing to its being a soft wood, it is easily worked, and looks very well either simply polished, or stained and varnished to bring out the markings (called flowers), or painted to suit the colour of the walls and woodwork. Yellow deal is a better wood for furniture than the white deal of which I told you kitchen tables and utensils are made, and is very little dearer.

A few months ago I paid a visit to Messrs. Jackson and Graham's large furniture place in Oxford Street, London, to see the two rooms they have fitted up with furniture made entirely of yellow deal, from designs furnished by Robert W. Edis, F.S.A.,[1] a gentleman who is desirous people should see that good, genuine, artistic furniture can be made of this inexpensive wood. In one room the furniture was French polished, and in the other painted white. On the walls were various kinds of cupboards that I greatly admired. Cupboards are most important and useful pieces of furniture, especially in cottages where it is necessary to utilise the wall space as much as possible. Nothing furnishes and ornaments a living-room more than an old-fashioned dresser, with shelves above and drawers beneath; or, in case the room is small, a hanging cupboard, with only sides and shelves, filled with crockery, would look very well; and a corner cupboard with a glass door, in which the china, glass, and ornaments can be safely displayed without fear of breakage or dust.

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[1] Author of *Town Houses.*

Really good furniture is frequently found in cottage houses in country towns and villages, sometimes ingeniously constructed to economise space, made either by a member of the family or a good carpenter. In the town of Whitby and its neighbourhood I have seen excellent furniture in the houses of working people. At Egton Bridge, a lovely little village about seven miles from Whitby, I saw some chairs that had been made by a carpenter, now dead, of the name of Frankland, who for fifty years had supplied the cottages for miles round with comfortable and strong arm-chairs and single chairs, made of ash with rush-bottom seats, both light and inexpensive. A friend told me that her aunt had had one of these chairs in use for forty years; it is still perfectly good, and the wood has become a beautiful colour, though only polished with turpentine and beeswax. Some people who bought these chairs preferred to have them painted. Ash and birch are the least expensive kinds of hard wood; birch is cheaper than ash. The arm-chair cost six shillings, and the single chair four and sixpence. I hope Mr. Frankland's son will carry on his father's trade.

You shall now see photographs of these chairs, and also a photograph of an arm-chair of yellow deal (p. 101) made for me by a Whitby joiner. The carving is done by hand by a Whitby man who taught himself the art. I had an idea before I ordered this chair that strong, light, and inexpensive chairs could be made of deal, but I found this was not the case, because deal, from being a soft wood, would naturally become very weak when divided into the slender pieces of which ordinary chairs are made. Deal is only suitable for a strong seat like my chair, that has nothing slender about it, and the great amount of wood required to give strength causes

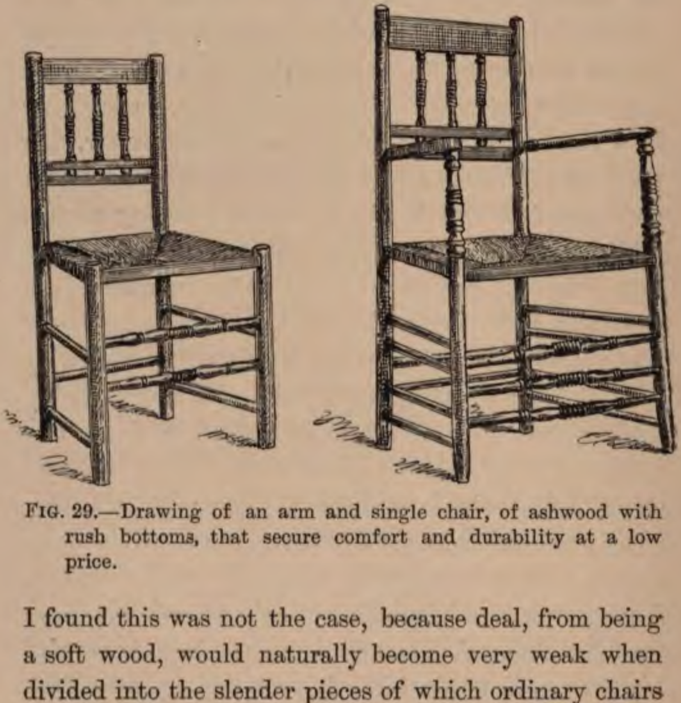

FIG. 29.—Drawing of an arm and single chair, of ashwood with rush bottoms, that secure comfort and durability at a low price.

a deal chair to be heavy and expensive. This chair cost 2*l.* 6*s.*

During my visit to Egton Bridge I went into a house more than two hundred years old, where I discovered an old-fashioned seat of oak, finely carved, called a settle, standing near the fire, that was quite as old as the house. The back, which was high (about 3 feet), kept off draughts like a screen; the arms were low; the space beneath the good broad seat formed a box; and, by means of a pillow and cushions, this seat was also made to serve the purpose of a sofa. As I looked at this old piece of furniture it struck me that a settle, constructed of yellow deal and polished, would exactly suit the living-room in my model cottage, take up less space, and be more comfortable and less expensive than a common sofa, such as I have already described, with a narrow padded seat, &c. Seats fitted up with loose

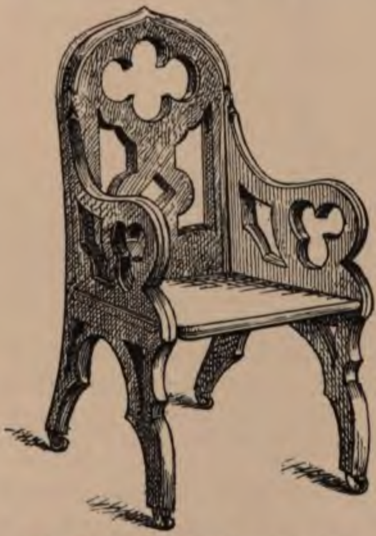

FIG. 30.—Arm-chair of yellow deal polished.

cushions are also less expensive and more cleanly than padded ones, because the former can easily be taken off and cleaned or renewed when dirty.

This drawing shows you a settle made of yellow deal on casters, to be either French polished or stained, and

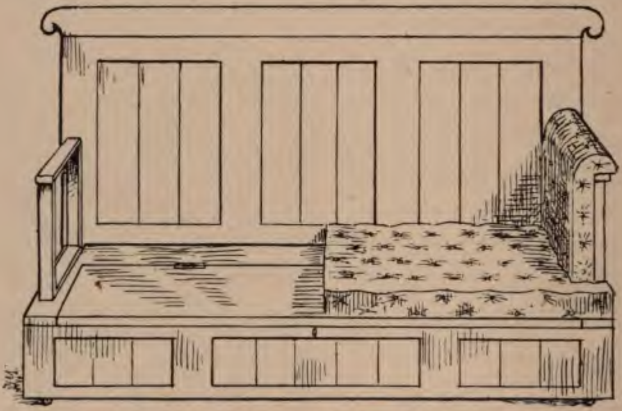

FIG. 31.—Settle of yellow deal polished, with a box under the seat, and so constructed that it also makes a comfortable sofa. The cushions on the left are removed to show the box.

polished with turpentine and beeswax. The seat forms a box, and the loose cushions for the seat, with the two for the side rails, make the settle into a comfortable sofa. This design was prepared for me by a London upholsterer,[1] who also very kindly furnished me with the following particulars to enable a joiner to make one for himself at a comparatively small cost, provided he set about it in the cheapest way.

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[1] William Booty, 139 High Street, Notting Hill, W.

DIMENSIONS.

Total length, 6 ft. 6 in.

Height over all, 4 ft. 3 in. to 4 ft. 6 in.

From ground to seat, 1 ft. 3 in.

Cushions on seat, 3 in.

Back, 3 ft. thick.

Back to front, 2 ft.

Wood, 16*s.*; the panels to be of match boarding, which can be obtained of the necessary thickness at any timber yard.

One pair hinges, 4*d.*; 1 lock, 1*s.*; 1 set of casters, 1*s.* 6*d.*

Flock for cushions and canvas for ditto, *also time for making*, 19*s.*

Total cost 1*l.* 17*s.* 10*d.*, reckoning it was done by a joiner or cabinet-maker for his own use, and consequently allowing the bare cost of his time.

Every piece of furniture ought to rest on casters, so that it can be easily moved to allow the dust that collects behind and under it to be taken away.

If people could only be made to understand and realise the important fact that the dust in their houses always contains the food upon which germs of disease and vermin live and grow (called organic matter, produced by human breath and perspiration), they would, I am sure, furnish their houses in a much more sensible and healthy way, especially their bedrooms. These rooms are often crowded with heavy, unsuitable furniture, and ornaments that take away the airy, comfortable, and cheerful effect so important at all times, and especially in illness. A bedroom ought to have as little carpet or woollen material as possible, because woollen materials hold dust; and it should be so fitted up that the whole room, furniture, floors, ceilings, and walls can be easily kept clean by simple and cleanly methods.

For instance, before sweeping a room, the furniture ought to be moved from the walls and covered over (the covers might be made of pieces of old cotton dresses and underclothing patched together); when the sweeping is done, and before the dusting begins, the windows should be opened to let the dust in the air escape. The ceiling and walls should then be dusted with a clean cloth or bag put over a long-handled broom or mop, and every article in the room be thoroughly dusted with clean dusters, which should be frequently shaken out of the window. I have been told that a cobweb will retain the germs of disease. The art of dusting consists in removing the dust into the *duster*, not in sending it flying into the air to make the air dusty and impure. Our furniture throughout the house is washed once a year with tepid water with a little soap dissolved in it, rinsed with cold water, and then well rubbed with a leather. Unless a servant is provided with proper cleaning materials, and has been well trained, her labour will all be in vain, because the dust will only be moved from place to place, the furniture made more dirty, and the air less pure than when she began her work. The servant should also wear a cover and hood to keep off the dust.

Bedsteads of the present day are lighter and more healthy than they used to be. The heavy four-post bedstead, with curtains drawn all round to keep out every breath of fresh air, is quite gone out of fashion. To prove how unhealthy they must have been, a bird was once suspended in its cage inside a four-post bedstead (to keep it warm, I suppose), and when morning came the poor little bird was found dead, poisoned by the bad air from the sleepers below. A great many bedsteads have now no curtains at all, except sometimes a short valance round the bottom of the bedstead, about three inches from the floor to allow air to circulate under them. Wooden bedsteads are now rarely asked for, as they are less cleanly, more expensive, and harder to lie on than those made of iron.

In selecting a bed the great point is to secure ease, comfort, and durability, by the simplest means, so that a bed can be easily made, kept clean, and purified after illness. Judging from my own experience, I should say that these advantages can best be attained by an iron bedstead, a wire mattress, and one of hair, flock, or alva. A bed of this kind, I find, is easily made by one person. The woven wire mattress in use throughout our house can be put on to any bedstead, as it is made in all sizes. A very inexpensive iron bedstead with a woven wire mattress all in one is said to be most comfortable when merely covered with a very thick blanket.

I find that a small bed of this kind that folds up, made by one of the best makers, can be bought for less than 30*s.*,[1] about the price, I am told, working people pay for a feather bed.

Feather beds are not considered healthy, and require a great deal of daily care to keep them clean and smooth, because the feathers become clogged together by the perspiration which of course must enter every bed. A feather bed ought to be well shaken every day by two people, and exposed for an hour at least to fresh air. The feathers should also be cleaned from time to time; all beds and mattresses ought to have loose covers to keep them clean. Cheap feather beds are filled with common feathers, often not properly cleaned, so that pieces of skin remain on the stem, which soon cause the bed to have an unpleasant smell.

I hope you will always, before quitting your bedrooms, open both a window and door to let fresh air pass through the bed and bedding. There is a rule in our house that the windows are to be opened and the bedclothes turned down for at least an hour before the beds are made. This hour can be well occupied by emptying the slops, clearing the chamber service, &c. in all the bedrooms. Beds, I find, are generally made up directly a room is left, before the bedding has even had time to cool. The windows in all our rooms are easily opened and closed, because the space in front of the window is kept free from furniture. Unfortunately, this part of the bedroom is always, as a rule, occupied by a dressing-table, in order that the looking-glass may stand with its back to the light, a good position for seeing oneself, but a very bad position for many reasons; for instance, a gust of wind may blow the looking-glass down, the table may be covered with dust, and then the difficulty of getting to the window will naturally lead to its being seldom opened or dusted. I consider the window-frame, and each pane of glass, ought to be dusted daily, with more care, if possible, than any other piece of furniture, to enable every ray of light to enter, and also to save as much as possible the cleaning of windows, a work so often attended with great danger.

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[1] John B. Rowncliffe & Co., Manufacturers of the Sanitary Woven Wire Mattress sold by W. Booty, 139 High Street, Notting Hill, W., and by any good upholsterer.

CHAPTER XI.

CURTAINS, CARPETS, AND DECORATIONS.

I AM very glad to say that people who consider health and cleanliness of the first importance are now giving up the expensive and uncleanly English custom of covering their rooms entirely with carpet, especially bedrooms; pieces only now are laid down, that can be easily taken up and shaken. When a bedroom or sitting-room floor is only partly covered with carpet, the flooring around the room can be decorated in various ways; the least expensive method is to stain the wood, and then polish it with turpentine and beeswax. I think plain white deal boards, when a good colour, look very nice in a bedroom, with bright strips of carpet round the bed and by the hearth. In cottage houses the style of flooring the living-room varies in different parts of the country. If I had a large family and only one living-room, I should prefer a good stone floor well laid and perfectly dry, or concrete covered with good cement, to wood, because wood soon looks dirty, is difficult to keep a good colour, takes a long time to dry, and also encourages blackbeetles, mice, crickets, and other vermin, which creep through the skirting-board and through the openings between the boards.

The most healthy and inexpensive way of hanging curtains is merely to have a window-pole or rod with rings to which a safety-pin is attached that pins up the curtains, or rings into which the hooks on the curtains can be fastened, so that they may easily

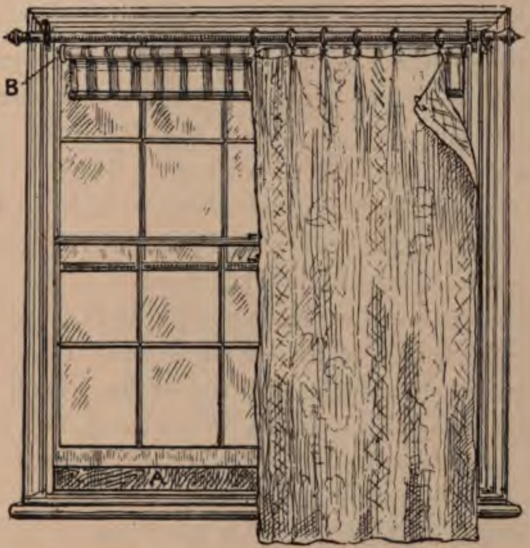

FIG. 32.—Drawing of a cottage window, showing how air can be admitted without rain or draught, with an inexpensive window-rod and curtain.

A, is a piece of wood (that can be removed) put to raise the sash and leave an opening in the centre. B, blind-rod fitted so that air can enter above it, not jammed close up to the frame.

be put up and taken down. The cornice and fringe, or valance, so often placed above the poles, prevent fresh air from entering, and have a very heavy appearance. This little sketch shows you how this sensible method of hanging curtains can be carried out at very small cost. The rod is a piece of wrought-iron gas piping three feet long (the width of the window-frame), three quarters of an inch in diameter, with the following brass fittings: two rod ends, two rod brackets, either screwed or driven into the outer edge of the window-frame, one dozen rings: total cost, about 3*s.* 6*d.* The rod can be painted, and the fittings also if of wrought iron, the same colour as the woodwork, but I find the iron rod does not look amiss without any paint.

The curtains, you see, only come, as they ought to do, to the bottom of the window-frame. Even when they are long they ought not to rest on the ground. Had I the choosing of the curtain for the living-room in my cottage dwelling, I should select a good cotton material with a pretty pattern, that would not require lining, and would wash well. After searching for three or four years I at last found a material such as I have described, in a draper's shop at Whitby, a pattern of which I have brought to show you (p. 111). It is a cotton damask, 7½*d.* a yard; and at the same shop I saw an unglazed cotton with a very pretty ivy pattern in crimson and black (Fig. 34), also 7½*d.* a yard, suitable for covering the loose cushion of the sofa, arm-chairs, &c. A chintz is a cotton with a highly glazed surface. In order to be sure that the colours in these materials were fast, and free from any poisonous matter, I sent pieces to a chemist to be analysed, and washed them myself in boiling water. The colours I found were perfectly fast, and the chemist assured me they were free from any poisonous matter. Several cotton materials called cretonne were shown me, with ugly patterns, gaudy and coloured, all of which vanished when I put them

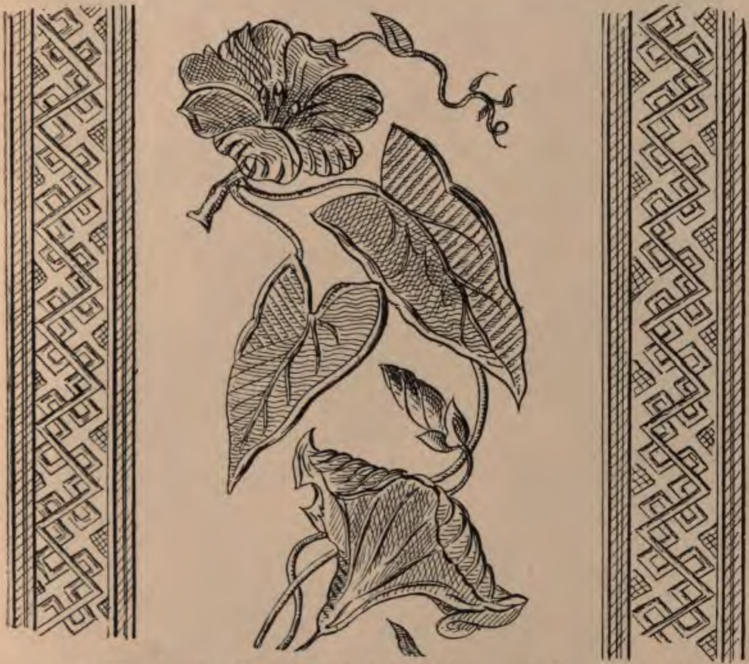

FIG. 33.—A red cotton damask for curtains, very cheap, pretty in colour and design, with fast colours.

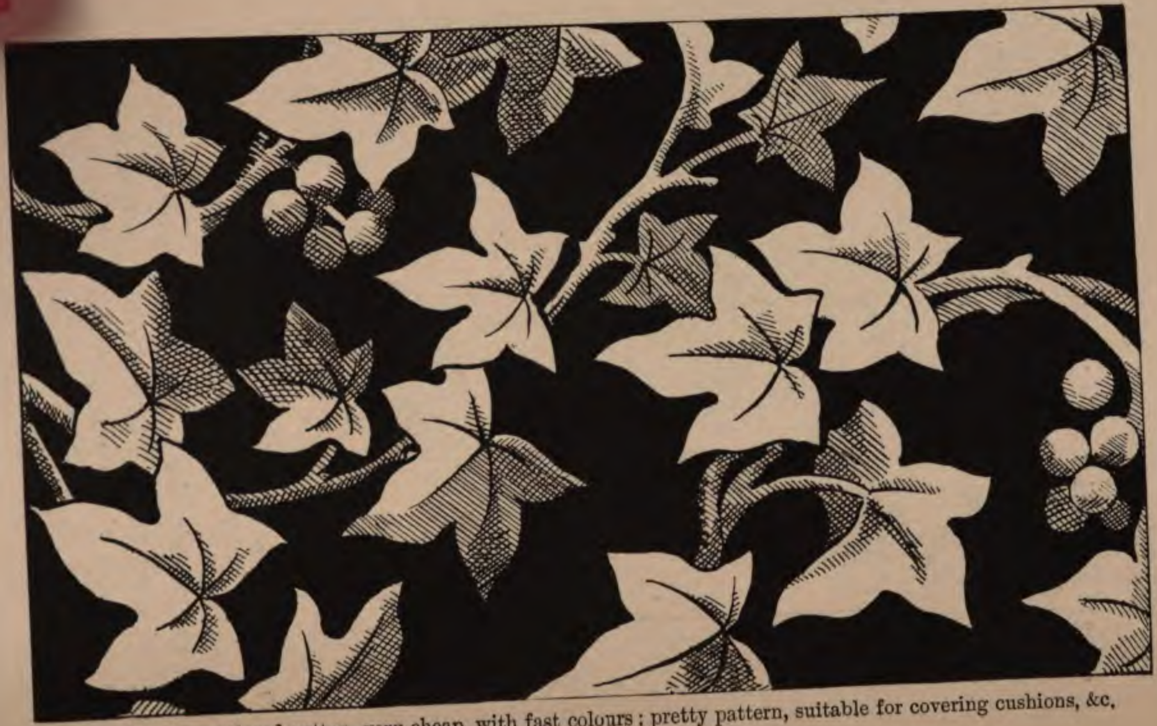

FIG. 34.—An unglazed cotton, very cheap, with fast colours; pretty pattern, suitable for covering cushions, &c,

into boiling water. The draper, Mr. Duck, of Flowergate, Whitby, told me that the two materials I had selected were manufactured by Messrs. R. Tee, Rycroft & Co., Portland Street, Manchester, though he had bought them from a London house, Messrs. Routledge & Co., 20 Cannon Street, London. I will now let you look at the patterns I have brought for you to see. I knew that the yellow tint in the wall would go well with the crimson colour of the damask and cotton, because I had covered a little table in the living-room in my model with a crimson cloth, and placed a small yellow bowl filled with moss, and a tiny fern in the centre, to see the effect.

Before concluding my suggestions as to suitable furniture and decorations I will make a few remarks about ornaments, because I sometimes see very silly and useless things called knickknacks, ugly in form and badly coloured, that spoil rather than ornament a room. Had I time I could mention a great many examples, but the following description of a vase for holding flowers will illustrate what I mean. A kitten on its back holds a ball in its paws, in blue and pink china. But the ball, which forms the vase, is so small and shallow, that it would neither allow room for the stems nor a sufficient quantity of water to keep the flowers alive. A white bowl or basin of the commonest ware would serve the purpose far better, and have a much prettier effect, because the white china would show off the different shades of colour to advantage, would give each flower room to display its beautiful form, and would hold a plentiful supply of water. The ornaments made by the Egyptians, Greeks, and Romans thousands of years ago are still considered the most beautiful, whether constructed of common clay or precious metals, because they were always designed for use; and their form, and the material of which they were made, suited the purpose for which they were intended. The water-bottle (Fig. 35) made by the Egyptians more than three thousand years ago is considered a perfect ornament, though constructed of common clay, baked in the sun; because the porous unglazed clay and the form of the bottle all assisted in keeping the water cool, and the rich colour of the clay made it pleasing and pretty to the eye.

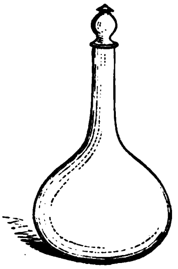

FIG. 35. — Drawing of an Egyptian water-bottle, to show the properties that constitute beauty.

The history of this bottle teaches us that a simple article of use may possess the qualities that make things beautiful and ornamental, and that it is therefore possible for the humblest home to be decorated with pretty things; for example, if the plates, dishes, jugs, bowls, &c., that stand on a dresser or shelves (such as I recommended), and the china and glass displayed in the corner cupboard, possess forms well suited to the purpose for which they are intended, and are good in colour, they are worthy to be called ornaments.

Flowers and pictures of beautiful country and seaside views are the ornaments that, I should think, people desire most who live in a smoky town. Thanks to photography, copies of beautiful pictures done by the best masters are now to be bought for a shilling or two. I took care that the window-sills in my cottage dwelling should be sufficiently wide to hold boxes and flower-pots, as I learnt from the Leeds School Board Flower-shows that it was possible for even children to rear some kind of plants in the most smoky parts of the town, provided they knew something about their nature, and how to tend them. Though the yard at the back of my model cottage is small, it might be made pretty by pots and window-boxes, and by covering the walls with ivy and a Virginian creeper, such as you see in this picture (Fig. 6, p. 32).

I do hope the day will soon come when houses for working people, provided with a constant supply of good water, similar to my model, will be built at a rent of 5*s*. 6*d*. a week, the sum a common labourer has now to pay for one room in London, where the water is perhaps both scanty and impure. The wife or widow of a working man would then be able to rear a healthy, modest family, keep her little ones from the street, and prevent infection from spreading in case of fever. She could also train her daughters in housework, and teach them cleanly habits, without which the most perfect house, surrounded by the purest air, may become unhealthy, and be visited by those terrible diseases I have so often mentioned. No good housekeeper, I find, likes to take a girl into her service from a family brought up in one, or even in two rooms.

We must now, I regret to say, bid farewell to my 'healthy dwelling,' to examine a model of an *unhealthy* working man's cottage, about which I shall have much that is sad to relate.

CHAPTER XII.

THE UNHEALTHY DWELLING.

WHEN I told the model-maker that I wished to show you a model of an unhealthy, ill-drained, badly constructed working man's cottage, he assured me there were hundreds of such houses in Leeds, and offered to make the model an exact copy of a house in which one of his workmen had lived for seven years, adding that this man would assist in its construction. Knowing that these facts would greatly add to the value and interest of the model, I gladly accepted the offer, and requested, when the work was completed, that I might see the workman, and hear from himself what his experience had been during the seven years he had occupied the house. When the model was completed, the workman brought it home, and after pointing out all the sanitary defects it contained, furnished me with the following sad particulars :—

It seems that when Mr. W. took the house he was a strong, healthy man, but during the whole of the seven years he had never known what it was to feel really well. A low fever once laid him down for eight weeks, and after that he suffered from attacks of bronchitis. His wife was always ailing, became rheumatic and nervous, lost her appetite, and used to wake in the morning feeling as tired as when she went to bed, and afraid to face the day's work that lay before her. Their children (six in number) were also constantly out of health. At last they lost their only little girl from scarlet fever. After this sad event occurred the husband said that he and his wife talked matters over, and decided that it would be cheaper in the end to spend a shilling more in rent, as the doctor was never off the door. The rent was 4*s*. 6*d*. a week. Who the landlord was no one could discover, as an agent collected the rent, and never divulged the secret. Ever since Mr. and Mrs. W. removed into a through house, somewhat similar to my model of a healthy dwelling, they have never required a doctor, and think had they only removed sooner they might still have had their little girl with them. Soon after receiving the model I called to see the wife, who told me she now felt quite a different person, and kindly gave me some additional information.

I also went to look at the outside of the unhealthy house, which appeared to me as I walked down the street to be one of a *single* row of twelve houses, and judging from the outside I should have taken them all to be very tidy dwellings. I then went round to the back, expecting to find that each house had a back-yard, instead of which I found another row of twelve houses,

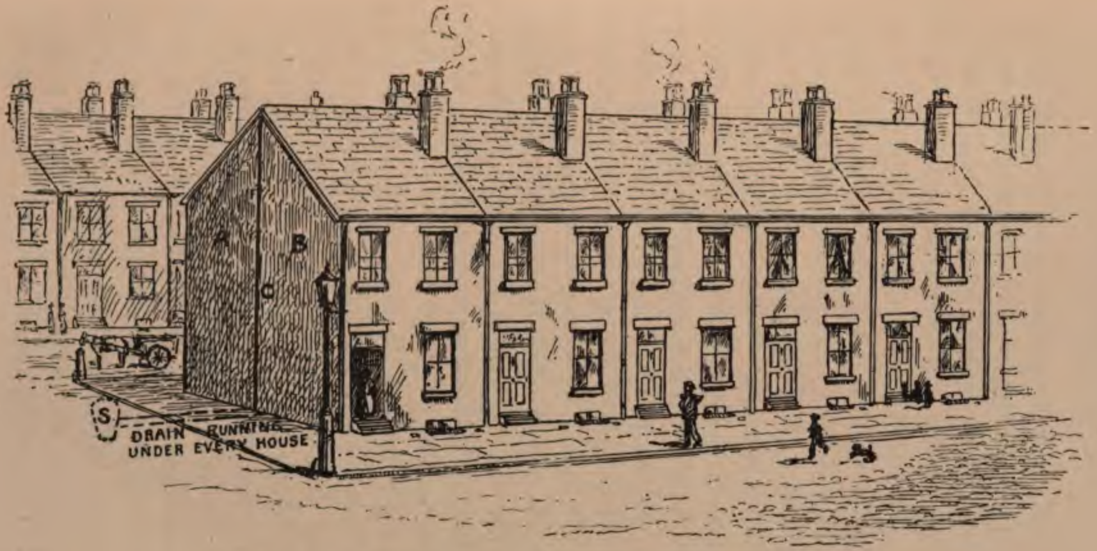

FIG. 36.—Drawing of a part of a block of 24 back-to-back houses.

C, dividing wall that separates the houses; A is one house, B is another house. The dotted lines show the house drain entering the sewer S, and the house drain passing down the centre of the block under the dividing wall C.

the backs of which were joined to the backs of the row I had just seen, making what is called a block of twenty-four houses, twelve looking into one front street and twelve into another. Houses built in this way are very properly called 'back-to-back' houses.

This picture shows you the end of the block, giving a view of six of the twelve houses in this row, and a small piece of the street that passes in front of the other row of twelve houses at the back. The dark perpendicular line in the picture, C, represents the dividing wall that passes down the centre of the block and separates the houses from each other. A forms one house, and B another. This drain entering the sewer, S, in the street is the end of the house drain, that passes down through the middle of the block under the dividing wall. This dividing wall is a *dead wall*, which means that it has no windows or openings of any kind to admit light or air.

Directly I realised that my model represented a back-to-back house, I knew it was constructed on an unhealthy principle and could never be made into a healthy house, and that I might find it did not even possess the arrangements requisite for the necessaries of life, for the following reasons:—(1) Because, as there were no windows or doors at the back, as well as in the front of the house, it would be impossible to cause a current of air to pass through the house to ventilate it. (2) The w.-c. in this kind of house must be placed in the middle, instead of being put by an outer wall in a projection where the soil-pipe could be taken outside the wall, as you remember was done in the w.-c. of the healthy dwelling. (3) The house drain must pass under the house. (4) In back-to-back houses overflow pipes and pipes that carry away the foul water from sinks, baths, called waste pipes, cannot be disconnected by discharging their contents into the open air, but must be joined to the drain that runs under the house which carries the refuse from the w.-c. (5) The dustbin has also to be fixed in some dangerous or inconvenient place for health, as there is no back yard in which to put it. (6) Instead of a w.-c. in each house two water-closets, or privies, under one roof, with an ashpit at the back, are provided, placed at each end of a block of eight houses—an indecent, cruel arrangement, which must lead to uncleanly habits and dangers to health when we consider the public pathway and distance a child or delicate person would have to go all weathers or at night. As it is a well-known fact that back-to-back houses must have these dangerous sanitary defects, the building bye-laws in London and some other towns forbid their erection, but in Leeds, I am sorry to say, there is no such bye-law, and back-to-back houses are therefore very numerous.

The model of one of them which I am now going to show you is a five-roomed house, consisting of two cellars, one living-room, and two bedrooms. As the front of the model is turned towards you, you can just see a little bit of the sitting-room A, and the staircase going up from it.

The top of the cellar window appears above the footpath G. The window on the left over the front door, and the one on the right, belong to the two bedrooms.

We will now try and discover whether my model has the five sanitary defects I have mentioned. Our search shall begin at the bottom by looking under the footpath G. Here you see is a box F (or three sides of one), fixed against the cellar

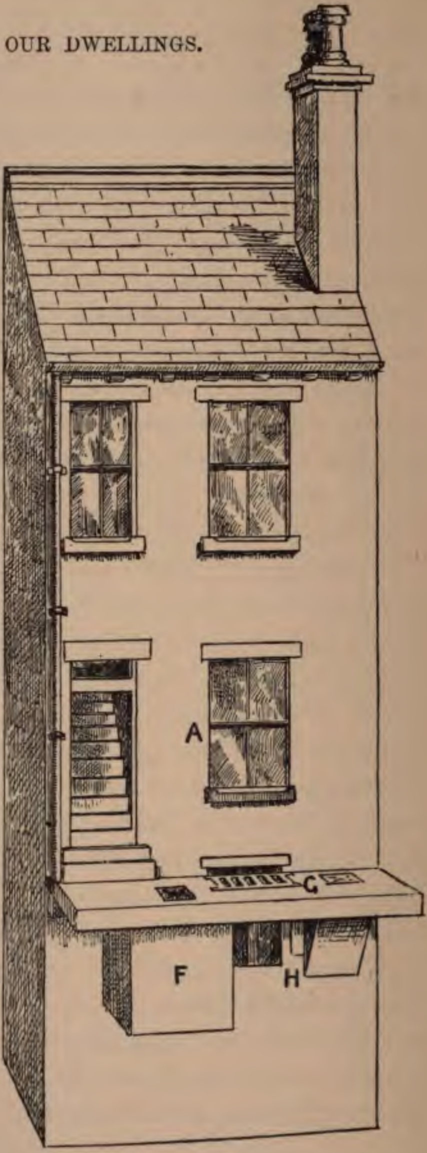

FIG. 37.—Drawing of a model of an unhealthy working man's dwelling.

H, lower part of cellar window.

wall. This box is the dustbin, or midden, into which every kind of animal and vegetable refuse is thrown, as well as the dust and ashes. All this refuse has to be thrown down the little door in the footpath. As rain can also run through this door the refuse is sure to become liquid in wet weather, and the moisture will then find its way through the wall and trickle down into the cellar. To make matters worse, I was told that the ashes and refuse were often not removed for two months. In warm weather you can fancy how the poisonous gases would rise from the wet refuse and spread over the causeway, and enter any open door or window. I could not help thinking of these sad facts as I passed the house and saw two little children playing on the door-step, and their mother sitting inside where she could watch that they got into no danger.

Before we leave the front of the house we must notice how the rain-water is carried away (page 122). Alas! the rain-pipe, you see, is not disconnected, but goes straight down through the causeway into the street drain. If you will look up to the top of the pipe, you will see that the mouth is placed so close to the bedroom window on the left that when the window is open, drain air will be sure to enter.

I will now turn the back part of the model to you; you will then be able to see the inside of every room, because the back dividing wall and the house on the other side of it have been removed (Fig. 38). We will first look under the cellar floor, and the first thing we shall see is a drain-pipe A, lying on a bad foundation, most likely made of refuse, because it is of so soft a nature that it has even sunk under the weight of the drain-pipe, and so caused it to break open at every joint. You must also

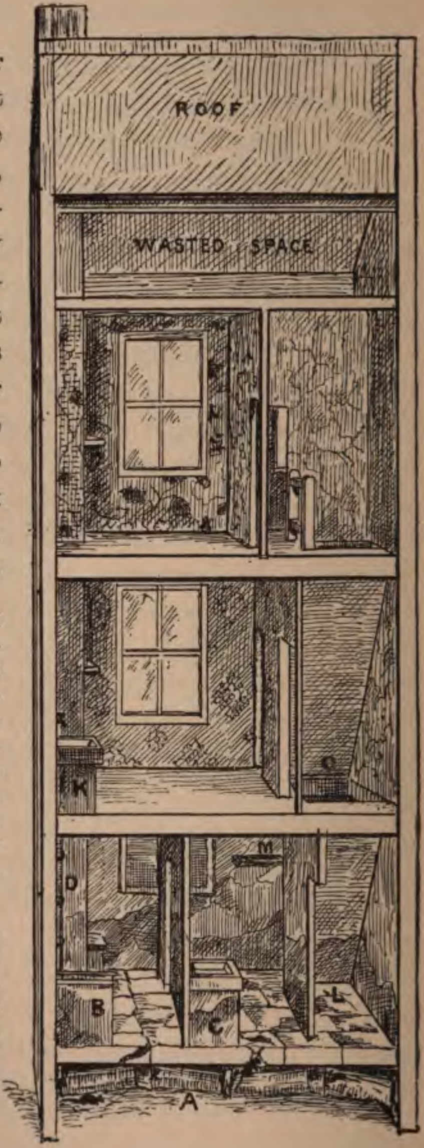

FIG. 38.—Drawing of the model of the back-to-back house with the dividing wall removed to show the interior of every living-room, the two cellars, and the house drain A, broken open at every joint, out of which rats are escaping into the cellar.

B, w.-c., in the cellar on the left; C, sink in cellar to the right; L, coal place; M, shelf for food by the wall next the dustbin; O, shelf for food at the top of cellar stairs; K, sink in sitting-room; D, sink pipe passing down cellar wall into the drain close to the soil pipe from the w.-c.

notice that the drain-pipe rises up in the middle instead of lying in a slanting position, so as to allow the refuse and foul water to run down it and fall into the drain in the street. As the refuse cannot pass down the pipe, it must escape through the open and broken joints of the pipes, and so run under the cellar floors. Terrible to say, this broken drain-pipe passes down the centre of the block just under the dividing wall, and has to carry the refuse and foul water from twenty-four w.-c.'s, twelve on one side of the dividing wall and twelve on the other, and the foul water from forty-eight sinks, because each of the twenty-four houses in the block has two sinks, but only one w.-c.

We had better examine the cellar floors, to see whether any of the sewage and foul water have run through the stone flags and made them very damp. These blue patches between the flags show the places where the sewage has run out, and how damp it has made the cellars. No wonder that poor Mrs. W. suffered from pains in her knees and joints, and from sickness, every washing day when she was obliged to remain in the cellar, because the boiler was placed there. Here is the boiler in the left-hand corner by the window. Whenever she threw water down the sink C in the cellar to the right, the smell, she told me, became more than she could bear.

Now let us examine the sink-pipe D. If you look under the cellar floor you can see this pipe, going without any trap straight into the drain. This pipe was a very bad one, gaping open down the sides. In the cellar to the left the w.-c., B, is placed in a corner by the dividing wall, with a miserable soil-pipe standing in the broken drain, also without a trap or ventilating pipe. Mr. W., being a workman, tried to mend the soil-pipe and sink-pipes, and so found out all about them. When he tried to repair them he discovered that the walls were only one brick thick, because in knocking the wall a brick fell out and left a hole, through which he could look into his neighbour's cellar. As there were a great many rat-holes near the w.-c. and sink-pipes, Mr. W. set a trap to catch the rats, and in one week he caught no less than eight. I have put some models of rats by the holes to show where they came out. A sink is a place they like best, because there they find grease, which is their favourite food.

The coal-place L is under the cellar stairs, the only place for it in a back-to-back house. Just picture the dirt that would be made on a wet day by carrying the coal through the living-room and down the cellar stairs!

You have now seen everything in the cellars excepting the places for keeping the food. I am sure you will all say to yourselves, 'Surely the food was not kept down in these damp cellars, filled with drain air?' I am sorry to tell you that every bit of food was kept here, as there was no other place in the house to keep it. Some of it was placed on this shelf O at the top of the cellar stairs, and the remainder on a shelf by the cellar window M, to be, as was thought, near the fresh air; but no fresh air came through this window, because you will remember the dustbin stands outside it under the causeway. The wall by the window to which the shelf is fastened is also very damp and covered with dark blue patches, showing where the foul water has entered from the decaying refuse in the dustbin.

We will now leave this terrible part of the house, and ascend the cellar stairs into the sitting-room, which occupies the whole space above the cellars (called the 'ground-floor'). Here in this corner at the back is the second sink K, with a bad pipe, not trapped, going down into the broken drain. The tap which you see over the sink furnished this unhealthy house with the only good thing it possessed, that is, a constant supply of fresh water, provided by the Leeds Corporation. The w.-c. in the cellar is supplied with water from the small cistern placed above, and inside it there is an overflow pipe that goes down into the drain. In through houses the Leeds Corporation require that all overflow pipes shall discharge their contents through an outer wall, but this cannot be done in a back-to-back house, as there is only one outer wall in the front.

The walls in this room, and in the two bedrooms above it, are covered with the common, dangerous wall-papers I showed you.

We will now go upstairs, and first look at the larger bedroom on the left, with a fireplace. Here the father, mother, and two children slept. The smaller bedroom, occupied by four children, had no fireplace. The window in this bedroom could never be opened at night, because the bed was placed close to it, and the door was also shut, lest the children should get up in the night and fall down the stairs. At the time Mrs. W. was describing to me how terribly close and hot the house became on a hot summer's day (as the rooms all faced one way, and the house had a south aspect), I could not help thinking how much more dangerous the house must have been on a cold winter's night when the doors and windows would be closed, because then the fire would draw the drain air from the bottom to the top of the house, out of the filthy soil and broken drains under the cellar floors.

CHAPTER XIII.

DRAIN AIR IN THE DWELLING.

In my model of a back-to-back house (which proved too large to carry from school to school) I was able to let my hearers see how the heat of a fire can draw air up in the way I have described. Though it was not possible to light fires in the model, I was able to get the heat of a fire by placing a lamp in the grate of the living-room and bedroom, as the chimneys were open to allow the heat and smoke to escape. When I had lighted the lamps, I put some paper (specially prepared to send out dense smoke but no flame when it was lighted) under the cellar floor by the broken drain-pipe, and then closed up the model by shutting a glass door at the back, similar to this one. My audience, by looking through the glass door, were then able to watch the smoke rising up from the damp soil and broken drains under the cellar floors, through the damp places in the stone flags, just as the drain air would have done. The smoke was seen coming out wherever there were any openings, through the rat-holes, the soil pipe of the w.-c. and sink-pipe into the cellar, then passing by the window-shelf M (p. 125), where the food was kept, and up the cellar stairs near the food, again on the shelf O fixed at the top of them, and so on into the living room, when some of the smoke was drawn across the room by the fire or lamp and escaped up the chimney; the rest of the smoke continued to go up the stairs and pass into the bedrooms, a little being drawn across the large room by the heat in the fireplace.

I must now tell you that by means of this experiment, called the *smoke test*, a great many very important discoveries have lately been made, that show how a fire or heat can not only draw drain air up to the top of the largest building, but can make it travel to every part, along the sides of hot-water pipes, gas-pipes, bell-wires, soil-pipes, and behind hollow walls. You will all remember how in my first lecture I told you that the largest and most costly houses are often found to be quite as unhealthy, badly constructed, and ill-drained, as those erected for the middle and working classes, and that mothers of every rank suffer from a terrible fever caused by drain air soon after their confinement, when they are recovering, called 'puerperal fever.' The following history of Bagshot Park (the residence of H.R.H. the Duke of Connaught, the third son of her Majesty the Queen) will prove that these sad statements were only too true.

Bagshot Park is an entirely new building, built at a cost of from thirty to forty thousand pounds. In this mansion her Royal Highness the Duchess of Connaught was safely confined of her first child (January 15, 1882).

As the newspapers gave a good report of the Duchess's health for the first ten days, the public were greatly surprised and grieved to hear, in the course of about three weeks, that her Royal Highness was seriously ill, and had been removed from Bagshot Park to Windsor Castle, as Doctor Playfair, the medical man in attendance, feared that the illness was caused by bad drains. After the departure of the Duchess to Windsor, Mr. Rogers Field, the distinguished sanitary engineer, was sent down to Bagshot Park by H.R.H. the Duke of Connaught to make a thorough examination of the drains. As it would be vain to try and explain the numerous experiments Mr. Field performed in order to find out whether the Duchess's illness had been caused by drain air, I must content myself with giving you the following facts, which I hope you will now be able to understand.

When Mr. R. Field had discovered that the drain passed under the house he used the *water* test, to find out whether it was water-tight; that is, he plugged up the drain at the lower end, and then continued for some time to pour water through an opening at the other end—the part that was highest—but it was all in vain trying to fill the drain, for the water all escaped, some of which was seen running out of the drain into the basement. [I must tell you that above the basement (on the ground floor) there was a large central hall, a vestibule, and a dining-room.] Mr. Field also discovered in another part of the basement a pipe going into the drain and standing exactly under the floor of the 'vestibule;' as the top of the pipe was left open, the drain air would, of course, be constantly escaping.

Mr. Field then applied the smoke test to see whether any of the drain air in the basement could have found its way up into either the central hall, vestibule, or dining-room, and from these rooms up into the Duchess's bedroom and dressing-room. He first placed some smoke paper in that part of the basement where the water ran out of the drain, just under the central saloon. In a very short time the smoke was seen coming out of some hot-water pipes in the central saloon, and then out of some hot-water pipes that were in the gallery above, out of which the Duchess's bedroom and dressing-room opened. Mr. Field then went to that part of the basement where, you remember, I told you the open pipe stood, and placed some smoke-paper close to this pipe. Very shortly afterwards smoke appeared in the dining-room, and then was seen coming out of the wooden casement which covered the soil-pipe in the w.-c. in the Duke's dressing-room, out of which her bedroom opened.

I fortunately possess a plan of Bagshot Park, that just shows you the central saloon, a part of the gallery above where the coil of hot-water pipes stood, the dressing-room and w.-c., and the Duchess's bedroom.

The arrows show how the smoke or drain air flew up from the hot pipes in the central saloon, passed through the doors of both the dressing-room and bedroom, and

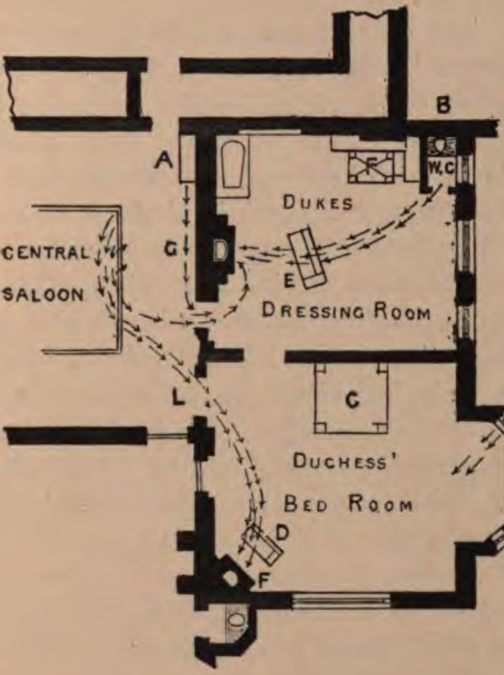

FIG. 39.—Plan of Bagshot Park, the residence of his Royal Highness the Duke of Connaught.

G, gallery ; A, waterpipes ; L, door ; F, fireplace ; D, sofa before the fire ; H, window kept slightly open ; C, the bed ; E, sofa placed in front of the fire in the dressing-room. The arrows point the different places over which the drain air passed.

was then drawn across both these rooms and up the chimney by the heat of the fires. The arrows also show

how the drain air from the w.-c. was drawn across the dressing-room by the heat of the fire.

The letter C in the bedroom shows the place where the bed stood; at H a window is seen, which was generally kept slightly open. No drain air, you must notice, passes by the bed, and for the first ten days the Duchess remained in bed she felt quite well. On the eleventh day she got up and lay on a sofa D, placed in front of the fire F. The arrows show how the heat of the fire drew the drain air from the central saloon through the door L, exactly over the place where the sofa stood, and it was on this day (January 25) that the Duchess was first poisoned with drain air, because the next morning she first complained of being poorly, had a headache, and remained in bed. The day after that (January 27) her Royal Highness got up, and again lay in the same place on the sofa D before the fire. On the 28th the Duchess moved into the dressing-room, and rested on the sofa E, placed in front of the fire. The arrows again show how the heat of the fire drew the drain air from the w.-c. exactly over the place where the sofa stood. The next day (January 29) Dr. Playfair found that the Duchess had every symptom of 'puerperal fever,' and her Royal Highness was at once removed to Windsor Castle, where, you will all be glad to hear, she was quite restored to health.

Had the Duchess remained at Bagshot Park, I greatly fear there would have been little chance of her recovery, judging from Mr. R. Field's report (published for the benefit of the public, at the desire of H.R.H. the Duke of Connaught).

This report states that all the drains, inside and outside Bagshot Park, were found without exception to be leaky; and the filth that collected in them ran out into the ground. Certain sink and bath pipes passed under the house into outside drains, and were so completely stopped up with a slimy substance that it was some time before any water could pass through them. The water-pipes of the baths and the pipes from the sinks went into the drain (unventilated), instead of discharging with open ends into the fresh air. The soil-pipes were badly jointed and broken, so as to let out the refuse. Every w.-c. had a disagreeable smell, and some were excessively offensive. Many of the inmates had suffered from various forms of indisposition, such as sore throat, diarrhœa, and a general sense of heaviness, &c., and these chiefly attacked new-comers. Mr. R. Field concludes his report by saying that he considered the house in the condition in which it then was unfit for habitation.

CHAPTER XIV.

CONCLUSION.

THE more I see and hear about the unhealthy houses of both rich and poor, the more convinced I feel that we shall never have healthy, comfortable homes until people are taught when young, especially the children of the working classes, to understand the 'laws of health,' the principles on which a house must be built to be healthy, and the dangers which arise from breathing drain air.

For instance, had Mr. and Mrs. W. possessed this knowledge, they would never have taken a back-to-back house. Directly I learnt that a great number of back-to-back houses were still being built in Leeds, I called on an official of the Corporation to inquire the reason of this. The cause, he said, arose from the fact that there was still a great demand for these houses, and that owing to the ignorance that existed about sanitary matters, working people preferred them to those that were healthily constructed. As a proof of this he mentioned the name of a block of back-to-back houses that were taken at a rent of 6*s.* a week, in preference to *through* houses with a back yard, and their rent only 5*s*. 6*d*. a week.

Now that I have learnt to understand why it is dangerous to live in an ill-constructed, badly drained house, and know the careless and unscrupulous way in which labour is done, I should never be tempted to take a house, however satisfactory it might appear, or pay for drainage or any sanitary work arranged on the best system, until the work has been examined and the drain tested by a sanitary engineer who had no interest in the work.

I hope your fathers will protect themselves by establishing co-operative working men's building societies, that enable their members for a trifling annual subscription to secure disinterested advice from some well-known sanitary engineer.

Before taking a lease or repairing an old house, the landlord or tenant who wishes to let the house ought to be compelled to furnish drawings that will show every drain, water, and gas pipe, and any alterations made by the tenant since he took the house, because it frequently occurs that dangerous alterations have been made, of which the landlord knows nothing. I trust that women of every class will soon possess a sufficient amount of knowledge about the construction of the dwelling, to spread terror among unscrupulous landlords, tenants, speculative builders, and working men, and also create a demand for well-built houses. Before bidding you farewell I must express the hope that the instruction you have gained from my models and drawings may prove of immediate use to you, either at home or in service, and may enable you, when you are women and have healthy comfortable homes of your own, to keep them healthy, and protect your families from those terrible preventable diseases which yearly bring sickness, poverty, and death to thousands and thousands of people in England, the healthiest country in the world.

APPENDIX.

RULES.

KITCHEN DEPARTMENT.

The Scullery.

1. Let fresh air enter frequently during the day, and admit a constant supply during the night.

2. Clean the plate-rack every week with warm water, soda, and silver sand.

The Sink (Page 50).

3. Clean the sink, pipe, and trap every week as follows :—

Place a pail under the trap, remove the screw at the bottom of the trap with a strong skewer or a pair of pincers to let the water it contains run out, then put a bottle-brush (kept for the purpose) into the opening, and clean the inside walls of the sink, pipe, and trap, and the under part of the sink grating ; after putting back the screw to close the trap, pour a can of hot water and soda down the sink grating. Boiling water must not be used as it injures a lead pipe.

4. Before beginning to wash up, carefully remove the grease and all that remains on the plates or in the saucepans, and if unfit for use burn this with the cooking refuse, such as cabbage leaves, potato peelings, eggshells.

5. Keep a tidy jar by the sink during the day to receive the tea leaves, coffee grounds, &c. Do not allow any bits of grease to pass down the grating. Scrub the sink stone daily with hot water and soda.

6. Keep your dish cloths and brushes sweet by hanging them in the open air after being washed in hot soda and water. Rain will not injure them.

Grease-Trap.

The grease trap to be cleaned every week. See drawing of the trap and directions for cleaning it on page 91.

Dust and Ashes.

Description of best kind of dustbin on page 34.

1. Do not throw slops, water, or any kind of liquid matter into the place where the dust and ashes are kept, nor any kind of refuse, eggshells, potato parings, orange peels, cabbage leaves, &c. &c.

2. Never throw paper or rags into a dust place.

3. Take care the ashes are free from cinders.

4. Put the dust and ashes daily into the dust place, so that nothing may fall on the ground.

5. Be very careful to close the lid of the dustbin.

Disposal of Waste Paper, old Rags, Matches, and Night-light Cases.

Put all waste paper and rags into a bag of coarse canvas, to be, if possible, suspended in the dust-room in the area, or some out-building.

Burn the night-light cases and matches; never throw them into a W.C.

Emergencies.

The sinks and dirty water thrown down a water-closet

[illegible] or contain hair or any solid objects such as floor cloths, scrubbing-brushes, and pieces of soap, because hair and these solid objects have been known to stop up a drain and to cause a dangerous illness or loss of health. The handle must be held up until ten has been counted after pouring down the slops or any dirty water.

The safest place to empty a pail of dirty water is down a grating under which there is a trap that can be flushed with water from a tap placed above it.

The Water Closet.

Before using a w.-c. pull up the handle for a second, and after using it do not put the handle down until five at least has been counted, in order to secure time for a sufficient quantity of water to pass down to carry the contents *completely* and rapidly out of the trap, and also out of the house drain.

Thick paper must not be used, as it may stop up the drain. Newspaper or any paper covered with printer's ink is very injurious to health.

Packets of thin paper sold for the purpose are very cheap.

Directions for cleaning the 'Artisan' Water Closet.

First look at the drawing on page 51 which shows the form of the basin and trap, and also look at the drawing of the cleaning-brush on page 54. Have hot soda and water in the slop pail ready to wash the brush after it has been used. Push the brush down into the trap at the bottom of the basin and pull it up and down two or three times, brush round the basin, and then hold up the handle for about two seconds to allow plenty of water to flush out the basin and trap. When the brush is clean hang it in the open air. Do this every week.

Directions for cleaning either a Pan or Valve Closet.

First look at the drawing of the Pan Closet, page 69.

In both of these water closets the brush must only be used to clean the basin, because if the brush were pushed down through the opening at the bottom it would injure the movable pan or valve that opens and closes this opening, and if the brush were passed down it could neither clean the container nor the trap beneath it. These water closets when dirty must be taken to pieces and be cleaned by a plumber.

When the basin (in any kind of water closet) becomes discoloured from neglect or from not having been well flushed out every time it was used, spirits of salts must be rubbed over the basin with an old brush; after doing this the handle must be held up for two or three seconds to allow the water to wash the basin and remove the salts.

Directions for cleaning, with a diagram of a cistern, on page 77, *Fig.* 23.

The cistern for drinking water must be cleansed twice a year, in the spring and autumn. As the top of a cistern is a place much frequented by cats, the lid, if a wooden one, ought to be protected by a piece of tarpaulin, or some material that is watertight.

Directions for cleaning a kitchen boiler and cistern (*Page* 83).

The kitchen boiler and the cistern that feeds it must be cleaned once a year. Never use the water out of a kitchen boiler, or a boiler used for washing purposes, to fill a tea-kettle, or any saucepan in which there is food to be cooked.

Precautions necessary to keep a house free from drain air when the family are from home, or in a house that is to be let.

Every water-closet, bath, lavatory, and apparatus under which there is a trap, must be flushed with plenty of water every week, because when the water in a trap has evaporated drain air will escape up and into the house.

Directions for preparing and using Lime-wash.

Buy two-pennyworth of lime (in a lump), put it into a clean house-pail and pour boiling water to within two inches of the top of the pail. The lump should be light in weight or else it will not slake ; chalk lime is the best. Lime bought in a *powder* is comparatively useless. A good sized pail holds two gallons and a half. Should the lime-wash be too thick more hot water must be added. The lime-wash must be used soon after it has been slaked, for if kept a few days it loses its power of adhering to a wall. Though fresh slaked lime is very adhesive, some of the surface will rub off; this, however, may be prevented by adding half a pint of boiled oil or melted fat or tallow whilst the lime-wash in the pail is hot, when it will readily combine. Boiled oil can be purchased at an oil shop or at a grocer's. Half a pint is sufficient for two gallons and a half of lime-wash. When either the ceiling or the walls of a room have been lime-washed they are spoiled for ordinary distemper. Before proceding to lime-wash the old lime must be *brushed* off, as it cannot be removed by washing. Never mix *size* with lime, as the size or glue would be destroyed by the lime and be useless. A fibre stock brush is the best kind for lime-wash, and only costs 1*s.* 6*d.* to 2*s.* Brushes made of *hair* are destroyed by the lime. The following colours, price 3*d.* a pound, may be used : yellow ochre, umber, Venetian red, blue. (Do not buy Brunswick green because it contains a great deal of arsenic.) The colouring matter, first mixed in a little cool lime-wash, must be added after the oil and when the wash has become cold. The whole should then be poured through a coarse piece of canvas. One pound of colouring matter will be sufficient for two and a half gallons. The great advantage of lime-wash is, that it destroys any poisonous matter or germs of disease, and will even adhere to a wall that is damp.

Some people prefer lime-wash without any colouring matter.

Directions for preparing and using ordinary Distemper.

Distemper consists of whiting, colouring matter, water, and a substance which makes these ingredients adhere to the wall or ceiling, called size. Before a ceiling or wall can be properly distempered the old wash must be removed. This can be done by means of a brush and warm water; and the same stock brush with which the distempering is to be laid on is the best for the purpose, and is improved by being so used. If the wall is papered it must be wetted in the same way, and the paper peeled off; the wall must then be well washed and all the holes stopped with a putty made of warm size and whiting, softened if necessary with some of the distemper out of the pail. After a few hours the surface will be dry enough to take the distemper; if not, wait until it is, which can be ascertained by passing the hand over any doubtful place, and feeling will decide.

Distemper for walls should be prepared as follows: Have two clean house-pails ready. Into one pour about a quart of water, and then break up six balls of whiting into it, and mix it by hand into a stiff paste. Then on a piece of clean board or slate rub up with a clean knife the colouring matter decided on, mixing with it some of the thick whiting from the pail. When well mixed, put it all into the pail, remembering that it must be many shades darker than the tint decided on, as it gets very much lighter in drying. Add a quart more water, let all be mixed as before to a smooth paste, then pour in the size, and strain all through a piece of coarse canvas into the second pail, adding warm water so as to fill the pail to within three inches of the top. The distemper will not be fit for use until it is set, which will be from three to six hours, according as the weather is hot or cold.

Size can be bought at any oil shop at 1*d.* a pound; 'Young's patent size' is that most generally used. Or it can be made by soaking three-quarters of a pound of glue in three pints of cold water for twelve hours, and then slowly melting the whole, taking care not to let it burn or get hotter than the hand can just bear without pain. If the patent size is used, five pounds melted in a quart of water in a similar manner will be required. Add it to the distemper as before directed. The only difference between preparing coloured distemper for walls and the white for ceilings is, that the ceiling distemper may have about a pint less size to the pail than before stated, as it is not subject to as much wear as the walls are.

As it is considered better taste that a ceiling should not be perfectly white, a little umber had better be added, just enough to give a delicate golden tint, because this tint will look well with walls of any colour. The distemper for the ceilings must be mixed first, as they are, of course, done before the walls. An ordinary house-pail, which holds two and a half gallons, filled with distemper would serve for five ceilings in a small cottage, and about two pails would cover the walls of five rooms. It is possible to mix all shades of colour in distemper wash, but dark colours are more difficult to manage than light colours, such as yellow ochre, umber, salmon colour, pink, and Venetian red. Blue and green would be called dark colours. Colouring matter can be bought free from any poisonous substance at a *respectable shop* for about 3*d.* a pound, *except* Brunswick green, which always contains a great quantity of arsenic. I think the walls in a sitting-room, and especially in a bedroom, look very pretty with only one shade of any of the light colours I have mentioned. If a darker shade round the lower part called a dado is desired, a dado of Venetian red would look well with pink or salmon colour.

The great art in distempering is to do it quickly, so that the edge of the piece finished shall not get dry before the next piece is commenced, otherwise it looks cloudy where the two join. In starting a fresh piece, the wet edge of that just finished should be begun first, before it has had time even to commence to dry, thus 'keeping it alive,' as a painter would say.

The only suitable brush for distemper is called a hair stock brush. The size required for distempering a cottage would cost 5*s.* Though this sounds a good deal of money, it must be remembered that the ingredients are all very cheap.[1] When the brush is too much worn to be used for putting on

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[1] *Cost of the ingredients for an ordinary-sized house-pail of distemper, sufficient to colour five ceilings in a small cottage.*

	s.	*d.*
Whiting, 6 balls	1	0
Young's patent size, 4 lbs., or ½ lb. of glue .	0	4
Colouring matter (umber) ½ lb. . . .	0	1½
Total	1	5½

Cost of the ingredients for one pail of distemper for the walls, sufficient to colour two rooms.

	s.	*d.*
Whiting, 6 balls	1	0
Young's patent size, 5 lbs., or ¾ lb. of the best glue	0	5
Colouring matter, 2½ lbs.	0	7
Total	2	0

the wash it will serve to wash off the old distemper and clean the walls. The little border that runs above the dado in the sitting-room in my model (p. 13) is done by a process called stencilling. A long sheet of paper, varying in size from eleven to twenty-two inches, with a pattern cut out for marking through, is placed against the wall and then brushed over with distemper-wash. The sheet is then removed to another part, and so on until an impression of the pattern has been left the whole length of the dado. Stencilled sheets can be bought where artists' colours are sold, or at a painter and decorator's shop from 6*d.* to 1*s.* each. The difficult part of stencilling lies in keeping the pattern perfectly straight.

Cost of models: their sizes, and the addresses of the makers.

	£	*s.*	*d.*
Wooden model of healthy dwelling (size 22 in. × 10½ in., with backyard 31 in. × 10½ in.)	4	0	0
Wooden model of unhealthy dwelling (Maker, M'James Wood, St. Columbia Street, Leeds)	3	10	0
Glass cistern (Maker, E. Cetti, 36 Brook Street, Holborn, London, E.C.)	1	1	10
Fittings (Maker, Mr. Danby, Great George St., Leeds)	1	7	6
Stand (Maker, Mr. Danby, Great George St., Leeds)	0	4	0
Second model of backyard (size 13½ in. wide, 9½ in. deep, 28 in. long, scullery wall 11 in. high) (Maker, Mr. Danby, architect, Great George Street, Leeds)	3	5	6
Glass drainage (Maker, E. Cetti, 36 Brook Street, Holborn, London)	1	5	8
Syphon cistern (Maker, M. J. E. Bedford, Chapeltown, Leeds)	0	15	0

Precautions against the spread of Infectious Diseases.

1. The sick child and its nurse should be put into a large airy room, to which, if possible, sunlight should also be freely admitted, and should not leave that room *for any* purpose.

2. No other person should be permitted to enter that room.

3. A sheet, well saturated with a solution of carbolic acid in water (two ounces of the acid in each gallon of water used), should be hung across the door of the room. It should fall into a foot-bath half full of the liquid, and should *be kept* constantly *moist* with it.

4. All carpets, curtains, bed-hangings, and such like, should be taken away.

5. All excretions from the sick person should be received, *direct*, into vessels containing some of the solution of carbolic acid ; should be afterwards further disinfected by the addition of more of the acid, and then got rid of at once. To retain them in the house is a fatal mistake. *If it be necessary to retain them for medical inspection*, this should be done *out* of the house.

6. All linen, whether from the *bed* or from the *body*, should, immediately on removal, be put into some of the solution of carbolic acid, and be kept in it until they can be wrung out, and removed *out of the house*.

7. Such articles must afterwards be washed *by themselves* ; to mix them with other clothes in a general 'wash' is sure to end by spreading the infection.

8. Food, and other requisites for use in the sick room, should be brought to a table *outside* the damp sheet, and be taken in by the nurse when required.

9. Things that have been in the chamber, and have not been used, such as *food*, and so forth, should either be burned *in the room*, or immediately on leaving it.

N.B.—Of all dangerous things of this kind *milk is by far the most dangerous*. It not only most readily absorbs the germs of disease, but is the very best and most favourable material for their growth, multiplication, and extension. Next in point of danger of this kind to milk stand broth, 'beef tea,' and all animal infusions.

10. So soon as the fever is over (if it be one like

scarlet fever—after which the skin is liable to peel off—as soon as this 'peeling' begins) the whole surface of the body should be gently smeared over with oil, or some clean fatty material, to prevent the dispersion of germs and bits of skin into the air.

11. Any other children living in the house had better *not* be sent away. They may be infected already, and may break out in the disease, and spread it *in other places*; they had, therefore, better remain at home; but they should be removed to, and be kept in, the part of the house farthest away from the sick chamber. If they leave home, they are almost sure to 'catch' the disease when they come back.

12. When the illness is over, the room must be thoroughly cleansed and 'disinfected.' The first thing to be done is to have the chimney swept and made thoroughly clean. Then the ceiling and walls must be thoroughly washed down and re-colour-washed. The floor, and all articles of furniture that will wash, must be carefully washed with soft soap and water. Blankets, sheets, counterpanes, should also be thoroughly washed, and all the bedding that has been used should be thoroughly 'stoved.'

N.B.—In Leeds the Guardians undertake to do this stoving free of charge for anyone who asks them.

Lastly, when all cleansing is done, the door and windows of the sick chamber should be set wide open—weather permitting—day and night, for as long as the room can be spared, and then it may be safely used for its ordinary purposes again.

Precautions against Cholera.

If an epidemic of cholera should unfortunately visit our country, there are certain things which I think you ought to know about it, and which, if you know them, will give you confidence, and will help you to ward off the danger of an attack.

First, let me warn you against giving way to *fear.* Fear lowers our nervous strength, and so weakens our bodies as to make us very readily take infectious complaints. Fear depresses our minds, and takes away our power to think and act for the best. It induces us to run away from danger rather than to stand and face and guard against it.

When the cholera was raging in Italy, the people became so frightened that they ceased to be able to think for themselves, or to take any precautions to protect themselves. They were unable to nurse their sick ; they were unable to keep either their cities, their houses, or their persons clean ; they were too frightened to be able to cook their food, and they died by hundreds every day.

There was one man, however, braver and more noble than all the others put together, and that man was the good King of Italy. He was not frightened, and, instead of running *away*, he never rested till he had gone through all the places in which the disease was raging most, to see what he, with a calm, clear head, could do for his poor, helpless, panic-stricken people. His nobility begged him not to go ; his Government begged him not to go ; his people begged him not to go ; but go he did, and wherever he went, by judgment, by prompt action, and by seeing that certain necessary things were done, he helped to stay the pestilence !

Well, exposed as he was, did he take the disease ? No —no breath of it ever touched him, and so long as he lives, his people, and all good people, will bless and admire him, and will honour him for the bravery and pluck with which he acted.

Well, then, in such circumstances, the first thing to look to is

Cleanliness.

Cleanliness in all your surroundings.

Cleanliness in all your habits.

Cleanliness in your clothes.

Cleanliness in your persons.

Cholera is a disease bred of filth, nourished by filth, and spread by filth ; and, even if it attacks cleanliness, it does so feebly by comparison, and less dangerously. In its presence, therefore, see that everything about you is scrupulously clean : your house, your drains, the locality in which you live, your clothes, your persons. However much you may wash at ordinary times, wash *more* then. However careful you may be about your clothes—and especially about your body clothes—be more so then ; and do not permit dirt of any kind to come within range of you.

Next to cleanliness comes abstemiousness and carefulness in living.

You should live well, but not too abundantly ; your food should be perfectly simple and wholesome, should be well cooked, and should be carefully eaten at regular times.

Above all things you should avoid anything either tainted or unsound.

For this reason I should advise you to abstain from fish. This food is rarely as fresh in inland places as it might be, and when unsound is especially dangerous at such times.

Mussels, crabs, cockles, and shell-fish of that kind, which are *unwholesome* at all times, become *unsafe* then, and should be avoided ; and *white* meats, such as pork, veal, and rabbits, are equally dangerous.

Fruit, provided it be perfectly sound, need not, in moderation, be avoided; but I would especially caution you against the use of such as is the least unsound.

Unsound fruit—that is, fruit which is beginning to decay, either because it has been too long gathered, or has been much bruised, or is otherwise unsaleable in respectable shops—is largely retailed in the streets at very low prices on hand-carts. In ordinary seasons, such fruit is a very common cause of diarrhœa, and, in cholera time, is very dangerous, and should be wholly avoided by wise people.

Next to abstemiousness in feeding, abstinence from intoxicating drinks should be most rigorously practised.

Such abstinence is to be recommended at all times, but when cholera is prevailing, it becomes a positive duty to avoid anything which can be in the least degree hurtful to health.

The man or woman who indulges in drink in cholera time is lost.

Prudence would dictate that in every household a little brandy, *to be used strictly as medicine*, should be at hand in case of necessity; but it should only be used as medicine and under medical advice.

By the use of these means you will do more to protect yourselves from attack, twenty times over, than by dosing yourselves with medicines of all sorts and kinds that will be recommended to you by friends, by neighbours, and, worse than all, by unscrupulous advertisers.

If you see a flaming advertisement headed 'Cholera! Cholera! Cholera!' and declaring of some medicine that the advertiser wishes to sell that it is the only remedy against the disease, let me, as your true friend, advise you to avoid it. No single medicine is known which is able to cure cholera, and, by depending on anything of the kind you may be losing just the very time which is of the most mportance to you.

True cholera is always preceded by some quite painless diarrhœa; whilst this diarrhœa exists, the more active disease is 'brewing,' and then is the time when, if ever, it can be mitigated or cut short.

If, therefore, when cholera is in your neighbourhood, you find yourself attacked with painless but troublesome diarrhœa, receive it as a warning; go quickly at once to a warm bed; send immediately for skilled advice; and obey the instructions given you by your doctor as if your life depended on your doing so—which it does.

If you are too poor to employ a doctor of your own, send for the one in charge of the district in which you live. In all cholera times the authorities provide such, at any rate in all large towns, and plenty of doctors are, at all times, night and day alike, on active duty, and will be ready to attend to your necessities.

Then, having guided you into the hands of the doctor, there I must stop. My advice is only intended to help you to *avoid* an attack; but if, in spite of all the care you can take, an attack should seize you, then you must depend on better and more skilled advice than any I can give you.[1]

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[1] These Precautions have been drawn up for me by C. G. Wheelhouse, F.R.C.S. Eng.

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